

SCIENTIFIC AMERICAN

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. XXXVI. No. 17.
[NEW SERIES.]

NEW YORK, APRIL 28, 1877.

[\$3.20 per Annum.
[POSTAGE PREPAID.]

IMPROVED GAP LATHE.

We illustrate herewith a new and excellent lathe, which, from the fact that it is claimed to perform all the work usually done on several lathes of different sizes, will commend itself to the careful attention of all who require from their machine tools a wide range of capabilities, for reasons of economy both in space occupied and in first cost. The machine is a 30-inch swing lathe (ordinary measurement). It is 21 inches over the rest, and 10 feet 6 inches between centers, or 21 feet, if a shaft of not over 4 inches in diameter is passed through the spindle. By the use of the gap, a piece of work 48 inches in diameter and 26 inches in length may be turned; and by the face plate on the back end of the spindle, a wheel 9 feet or more in diameter can be bored. The boring bar is passed through the spindle, and is supported by a bush at one end, the other extremity being, as usual, carried to the rest. The speed of the lathe, with the countershaft running at 116 revolutions, varies from 290 to $\frac{1}{2}$ revolution per minute. Between these limits are included the proper speeds for turning anything that will swing in the gap. The machine also screw-cutting, and has a change-

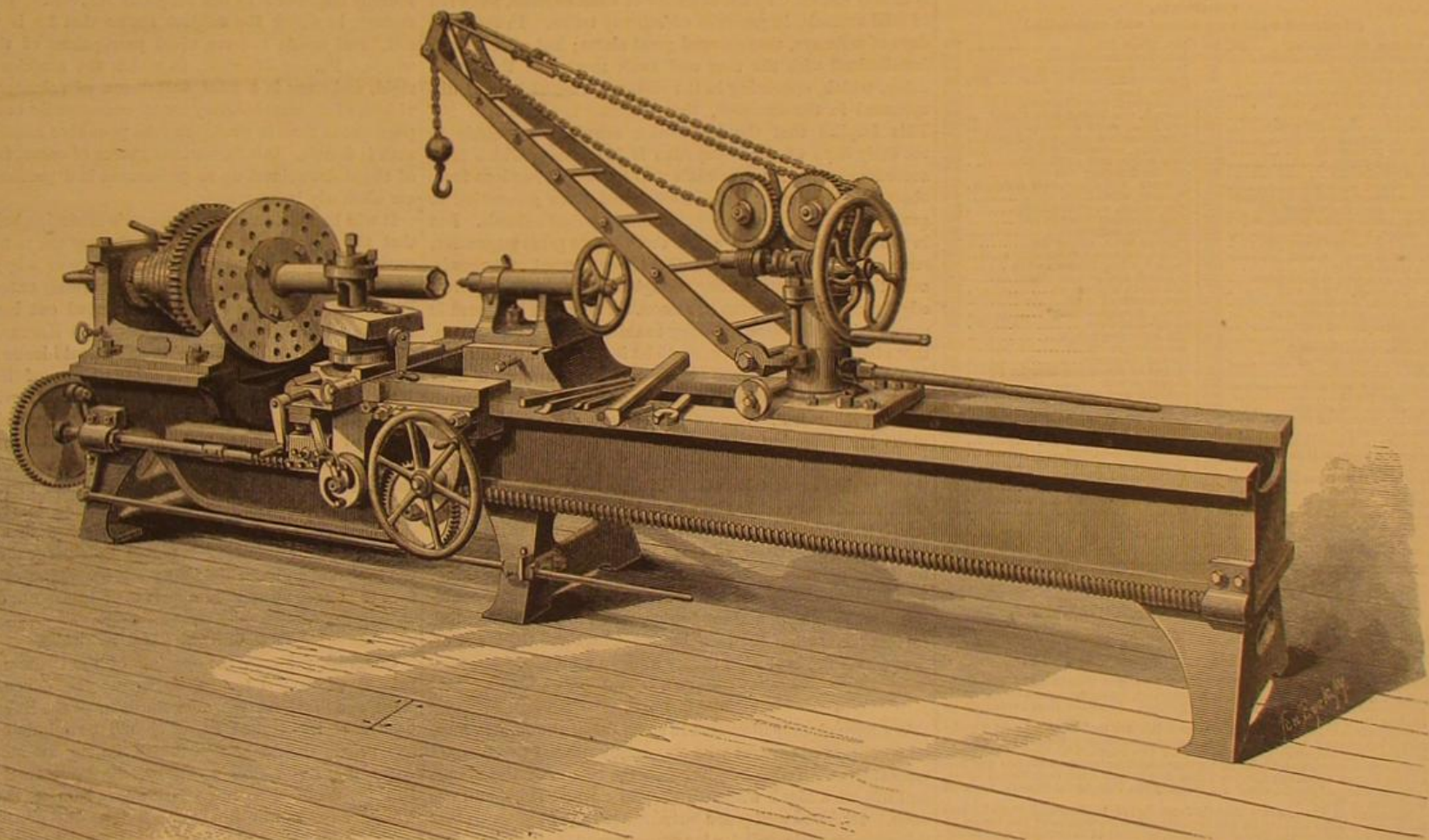
minute; but there are very few engines made which will not do much more than this for each nominal horse power. By this rule, a 10-horse engine ought to lift 320,000 lbs. 1 foot high each minute. Now some makers will give you an engine that will do more than double that work; while others will give you an engine that will only just do 320,000 lbs. and no more. No farmer, then, should buy an engine by its nominal horse power; he should ask some other questions, and get written guarantees from the maker as to what the engine really is. For instance, another of Watt's rules was that 1 cubic foot of water boiled off in an hour was equal to 1 horse power. Another rule to measure an engine by is the boiler surface exposed to the action of the fire, it being the custom nowadays to allow about 20 feet of boiler surface to each nominal horse power, that is to say, a 10 horse engine would expose about 200 square feet of surface to the action of the fire in the fire box and tubes, and of this from one fifth to one third would be in the fire box and the remainder in the tubes. If I were going to buy an engine, and wished to compare the prices of different makers, I would ask these questions: 1. Will you guarantee that all parts of

unable to tell the difference between a good and bad engine, would quickly disappear from the scene."

A Machine Dining Table.

A machine has been invented which may bring about a strike in a class of workers who rarely resort to such means of intimidation with objects other than securing more "nights out" or permission to entertain more admirers in the kitchen. We mean the waiting maids, whose occupation the machine dining table aims to destroy. The inventor says that it "is so constructed as to enable each person sitting at the table to bring the various dishes within his reach, which will enable the plates to be changed by mechanical means, allow each person to help himself to water when desired, which will keep bottles of wine and other substances cool, and which"—and here is luxury which reminds one of those frightfully expensive old Roman banquets—"shall be provided with a fountain to keep the air cool and refreshing."

We cannot pretend to describe all the mechanism. There is much of it. It looks destructive to children; but on the other hand it offers the advantage of a useful object for con-



WATSON'S GAP LATHE.

able cross feed of from 26 to 5 per inch. The rest is compound. The top rest will travel 12 inches, and the main rest the full length across the saddle. The tool post has three set screws, the center one for light and the others for heavy work. All three bear the strain directly through the center of the rest. The saddle is carried or supported over the gap by the lower ways, and on a level with the gap.

This lathe, we are informed, is as easily operated as any ordinary 30-inch lathe. The large face plate or gear is removable, so that, when the machine is employed for small work, its dead weight need not be carried. The trueness of the lathe, the inventor states, has been proved by turning a piece of work 4 feet in length clamped in the face plate and not supported by the back center. This has been tried, and the work has been found, by caliper measurement, to be accurate.

For further particulars, address Mr. James Watson, No. 1608 South Front street (below Tasker), Philadelphia, Pa.

Agricultural Steam Engines.

"In buying or selling engines," says a writer in the *Agricultural Gazette*, "it is usual to speak of them as being so many horse power. Now this is a very loose term, and opens the door to a very great amount of humbug. A horse power, according to Watt, was 32,000 lbs., lifted 1 foot high each

the engine and boiler are calculated to work at the usual pressure of 120 lbs. on the square inch of the safety valve above the atmospheric pressure? 2. Will you guarantee that the boiler has 20 square feet of heating surface for each nominal horse power? 3. Will you guarantee that the boiler will boil off at least one cubic foot of water (6 $\frac{1}{2}$ gallons) for each nominal horse power in the hour? 4. Will you give me two cylinders, and will you guarantee that each is arranged with separate cut-off valves, so that I can cut off the steam at any period of the stroke, and in such a way that I can alter the cut-off without stopping the engine, and say about 15 square inches of piston for each nominal horse power? 5. Will you give me a separate crank shaft for each cylinder, with a governor and a flywheel for each, and so arranged that I can work them either separately or both together, passing all the power through one flywheel if I wish? 6. If it were a traction engine, I would ask to have two speeds, one intended to use up all the steam (when expanding six times) at four miles per hour, and the other to use up all the steam at two miles per hour.

"If every farmer, before he bought an engine, asked all these questions and got a written reply to them, I venture to think that farmers' engines would very soon be greatly improved in quality, and that many makers, who at present exist as makers of engines solely because their customers are

temptation or topic of conversation for a dinner party of mechanical engineers. It might lead to disagreeable feeling among guests, if one should insist on revolving the middle portion, on which the dishes are placed, just as another was about to himself to some dainty morsel; and the stronger guests moreover would have an unfair advantage over the weaker ones, because they could forcibly adjust that rotating top so that the tidbits would come before their own plates. And when "the plates are to be changed, the crank, H¹, is turned, which lowers the plate that has been used, carries it in beneath the table top, and raises a clean plate through the opening." Supposing somebody should turn, accidentally, somebody else's crank, H¹, there would be another *casus belli*, for who could sit silently by and see his dinner sink, like the ghost in Hamlet, without feelings of resentment against some one, especially if hungry? There is a reservoir over the table and a system of waterworks under it, with a faucet for each plate. If something should leak, the unfortunate guests might in politeness sit still, while they contracted violent colds, owing to the soaking of their nether extremities. The invention is an ingenious one, but we fear it is not calculated to impress the precepts of the Golden Rule.

A good harness dressing may be made of neatsfoot oil 1 gallon and lampblack 4 ozs., stirred well together.

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT
NO. 37 PARK ROW, NEW YORK.

O. D. MUNN.

A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year, postage included..... \$3 20
 One copy, six months, postage included..... 1 60

Clubs.—One extra copy of THE SCIENTIFIC AMERICAN will be supplied gratis for every club of five subscribers at \$3.20 each; additional copies at same proportionate rate. Postage prepaid.

The Scientific American Supplement

Is a distinct paper from THE SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly; every number contains 16 octavo pages, with handsome cover uniform in size with THE SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, \$5.00 a year, postage paid, to subscribers. Single copies 10 cents. Sold by all news dealers throughout the country.

Combined Rates.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, postage free, on receipt of seven dollars. Both papers to one address or different addresses, as desired.

The safest way to remit is by draft, postal order, or registered letter. Address MUNN & CO., 37 Park Row, N. Y.
 Subscriptions received and single copies of either paper sold by all the news agents.

Publishers' Notice to Mail Subscribers.

Mail subscribers will observe on the printed address of each paper the time for which they have prepaid. Before the time indicated expires, to insure a continuity of numbers, subscribers should remit for another year. For the convenience of the mail clerks, they will please also state when their subscriptions expire.

New subscriptions will be entered from the time the order is received; but the back numbers of either the SCIENTIFIC AMERICAN or the SCIENTIFIC AMERICAN SUPPLEMENT will be sent from January when desired. In this case, the subscription will date from the commencement of the volume, and the latter will be complete for preservation or binding.

VOL. XXXVI., No. 17. [NEW SERIES.] Thirty-second Year.

NEW YORK, SATURDAY, APRIL 28, 1877.

Contents.

(Illustrated articles are marked with an asterisk.)

Alexandra, the Ironclad*.....	256	Ink, black (35).....	257
Answers to correspondents.....	257	Ink, deep black (8).....	257
Apples, export of.....	257	Inventions patented in England.....	256
Babbitt metal plugs (45).....	256	Ironclad Alexandra, the*.....	256, 261
Belle Isle, blocking the straits.....	256	Lath, improved gap*.....	255
Boiler details (10) 257, (32).....	256	Lenses and diaphragms (6).....	257
Boiler, heating (31).....	256	Locust, the Rocky Mountain*.....	259
Boiler, proportions of a (37).....	256	Lye from wood ashes (40).....	258
Boiler, sediment in a (30).....	257	Magneto-photography, alleged.....	257
Brick for paving (38).....	256	Mercury, pressure of (33).....	258
Bull on the track, a.....	256	New books and publications.....	256
Burning fluid (37).....	256	Oil, deodorizing fish (21).....	257
Business and personal.....	257	Patents, American and foreign.....	256
Business stagnation in Germany.....	257	Patents, official list of.....	258
Carbonic acid from fruit (13).....	257	Pendulum, mercurial (26).....	257
Carbonic acid under pressure (11).....	257	Photographic camera (41).....	258
Cat teaser, the*.....	256	Platinum, melting (1).....	257
Cement for rubber bags (21).....	257	Plating bath, silver (24).....	257
Centennial surplus, the.....	256	Postage stamps, cancelling.....	256
Cold, catching (7).....	256	Prison for cholera cure.....	257
Correspondence, Washington.....	259	Rainfall and evaporation.....	257
Day, the length of the (9).....	256	Saw teeth marks (14).....	257
Dining table, a machine.....	256	Saw, teeth of a (10).....	257
Dipper, the, and north star (19).....	257	Saws, straightening*.....	259
Drills, diameter of (25).....	257	Sewer traps (44).....	258
Dual life.....	256	Silk-spinning fish, a.....	255
Dynamite, blowing.....	256	Soup, whole ox.....	256
Electricity, velocity of.....	256	Spring ailments.....	256
Engines, agricultural.....	255	Stains of smoke on marble (2).....	257
Engines for boats (23).....	256	Steam power.....	256
Eruptions, great.....	256	Sulphur and leather (10).....	257
Evaporation and rainfall.....	257	Syrup, testing (4).....	257
Fairbairn, statue of Sir W.....	257	Telephone, Professor Gray's.....	255
Fires, colored (18).....	256	Telephonic music.....	255
Flour spar in Massachusetts (3).....	256	Time ball in New York city.....	257
Friction on slide valves*.....	256	Trees, hide-bound.....	252
Gas regulator*.....	256	Triangle, area of a (30).....	257
Goldfish in fountains (12).....	256	Varnish, oil, for balloons (34).....	258
Harness dressing.....	256	Water tanks (45).....	258
Heat for hatching.....	256	Wells, sinking (49).....	258
Heat of steam and water (15).....	256	Winnans, Ross.....	255
Hurry and high pressure.....	256	Windwheel, power of (29).....	257
Hydraulic engine, new*.....	256	Yard stick, etc., improved*.....	252
Ice, export of.....	256		

TABLE OF CONTENTS OF
 THE SCIENTIFIC AMERICAN SUPPLEMENT,
 No. 69,
 For the Week ending April 28, 1877.

I. ENGINEERING AND MECHANICS.—The new Thirty-eight Ton Gun-boat Delta, for the Chinese Government. 1 engraving.—New Experiments with Marine Torpedoes in France. Possible improvements in Marine Propulsion. Navigation: Abstract from a recent lecture by SIR WILLIAM THOMSON; embracing interesting information upon the Rating of Chronometers; the Pressure Log; the use of the Planoforte sounding Wire; the most approved methods of Communicating between Ships; the use of the Morse Alphabet for Sea Telegraphy; the American Steam Siren. Particulars of the Contract for Raising the Vanguard.—Steam Launch Building in England. Removal of Cleopatra's Needle from Egypt to England, with 7 illustrations; a brief history of the monument, description of the vessel to be constructed around the great stone, method of launching, and many interesting details. Throthe Nest Bridge, Manchester, England. A. FOWLER, Engineer, with 2 pages of engravings.—Silver Mining in New England.
II. TECHNOLOGY.—Pipes for Gas and Other Purposes, with 17 figures. The Ball and Socket Joint; Harness Joint; Ordinary Joints and Special Pipes; General Directions for the Laying of Pipes Underground. A Thirty Foot Steam Yacht, by PADDLEFAST, with 5 illustrations. Recent Improvements in Aniline Blacks. By GUYARD. New Textile Inventions.—New Velvet-Dyeing Machine.—Nopalins, a new color.—Catechu de Laval for coloring linen and cotton.—New series of dye stuffs by the action of glycerin on phenol.—A New Combustible.—Photos on glass.—Celluloid.—Ornamental Candelaria, 3 illustrations.
III. LESSONS IN MECHANICAL DRAWING. By Professor MACCORD. With 12 illustrations.
IV. CHEMISTRY AND METALLURGY.—Determination of Carbon in Iron and Steel. By ANDREW S. MCCREATH.—Gypsum and Soda for glass.—Determination of Phosphorus in Molybdate of Ammonia.—Estimate of Urea by Hypobromite.—New Carbonometer.—Ammonium Sulphide on Copper Solutions.—Changes in Well Waters.—Action of Saline Solutions on Leads.—Madder Coloring Matters.—Analysis of Clays from China.—Laboratory manipulations.
V. MEDICINE, HYGIENE, ETC.—Contraction of Blood Corpuscles through the Action of Cold. By R. D. PIPER, M. D. With 3 engravings.—Liberty with nitric acid.—Dilution of the blood and feeding by the veins.—Physiological action of Alcohol.—Epidemic Diseases and their remedies.—Efficacy of Vaccination.—Hearing and the ears.—Painless Extinction of Animal Life.
VI. MISCELLANEOUS.—The Radiometer. By Professor C. A. YOUNG.—Sir William Grove on the Radiometer.—Experiments with the electricity of Torpedo fishes. New Method of Determining Refractive Powers. By H. C. SORBY.

Terms.—Scientific American Supplement, one year, postpaid, \$5.00. One copy of THE SCIENTIFIC AMERICAN and one copy of SCIENTIFIC AMERICAN SUPPLEMENT will be supplied gratis for every club of five subscribers at \$5.00 each. All the back numbers of the SUPPLEMENT, from the commencement, January 1, 1875, can be had. Price 10 cents each.
NOW READY.—The SCIENTIFIC AMERICAN SUPPLEMENT for 1876. Complete in two large volumes. Over 30 quarto pages; over 2,000 engravings. Embracing History of the Centennial Exhibition. New Illustrated Instructions in Mechanical Drawing. Many valuable papers, etc. Price five dollars for the two volumes, stitched in paper; or six dollars and fifty cents, handsomely bound in stiff covers.
 Remit by postal order. Address
 MUNN & CO., PUBLISHERS,
 37 Park Row, New York.

Single copies of any desired number of the SUPPLEMENT sent to any address on receipt of 10 cents.

A BULL ON THE TRACK.

When George Stephenson was before a committee who were inquiring into the nature of his locomotive, one farmer committee man, after hearing that probably the unexampled speed of twelve miles an hour would be attained, and realizing that the machine could not leave its rails, sagely remarked: "But, Mr. Stephenson, supposing cows should get on your track, before your engine?" "Well," replied the inventor quietly, "it would be bad for the cows."

If the questioner had framed his query to refer to bovines of the masculine gender, subsequent experience has shown that Stephenson's reply might well have been otherwise; for while the average cow is not run over, as a rule, except involuntarily, bulls have over and over again scorned to fly from locomotives, and, while being killed themselves, have wrecked the aggressive train. A remarkable instance of this happened recently in Virginia, just as a heavy freight train was approaching a bridge. A bull, with mane and tail erect, placed himself in the middle of the track, breathing fierce defiance. The engineer put on the brakes and blew his whistle; but the brute lowered his head and refused to stir. It was impossible to stop, and the engine struck the animal just as it was passing on the bridge, left the rails, and was precipitated on the trestle work, which gave way. The locomotive, tender, and six freight cars went down into the abyss, the boiler exploded, and the bridge and cars in a few moments were in flames. The bridge, which was 120 feet long, was entirely consumed, the locomotive of course was ruined, and the engineer was mortally injured. The loss to the railroad company amounts to over \$8,000. What became of the bull is not stated.

Mr. Herbert Spencer, in discussing the subject of the distinction which brutes are capable of making between animate and inanimate objects, says that, where intelligence rises beyond the merely automatic, the motion implying life begins to be distinguished from other motion by spontaneity. That the spontaneity of motion serves as a test, he considers, is clearly shown "by the behavior of tame animals, and even of wild animals, in presence of railway trains. In the early days of railways, they showed great alarm; but after a time, familiarized with the roar and swift motion of this something, which, appearing in the distance, rushed by and disappeared in the distance, they became regardless of it." This implies that the knowledge acquired by cattle in the early days of the locomotive is hereditary, which is in accordance with Mr. Darwin's well known deductions from observation of other traits, transmitted from generation to generation, in hunting dogs and other trained animals. But in the case of brutes in which there exists great pugnacity, such as bulls, it would seem that the sentiment of anger is, as in the case of man, strong enough to overpower the knowledge which is analogous to reason. There can be traced in man, besides, the same tendency to think, in moments of rage, that objects, which he knows to be inanimate, are animate. Made angry by resistance to his efforts, he may in a fit of anger swear at some senseless thing, or dash it to the ground, or kick it. "But," to quote Mr. Spencer again, "the obvious interpretation is that anger, like every other strong emotion, tends to discharge itself in violent muscular actions, which must take some direction or other;" and the same author goes on to show that, as generally the object of wrath is a living object, to the injury of which the muscular exertions are directed, so this same muscular discharge is, by force of association, turned upon an inanimate thing. The similarity of behavior under such like peculiar conditions, between man and the brutes, seems to add another link to that connection between human beings and the lower orders which the evolution theory aims to establish.

DUAL LIFE.

We have already discussed in some detail the curious mental condition of persons who apparently possess two distinct mental lives. To such individuals the events of the abnormal life are a blank while existing in normal state, and *vice versa*. Dr. Brown-Séquard has advanced the hypothesis that this phenomenal condition is a consequence of our two brains, of which he believes we ordinarily use but one, leaving the other nearly unemployed.

The Greenlanders have a queer belief that the shadow, which by day accompanies us wherever we go, at night wanders away and has adventures. This odd superstition regards the duality of life from another standpoint than the almost purely physically one of Dr. Séquard; and Mr. Herbert Spencer, in his new work on "Synthetic Philosophy," devotes some close reasoning to the primitive idea of our possessing an *alter ego*, and to the question of whether we do not form a conception of a mental self through the incomprehensible experiences of dreams. Dreams, he says, cannot be interpreted as we interpret them, in the absence of the hypothesis of mind as a distinct entity; and this hypothesis cannot exist before the experiences suggesting it. There are dream experiences, which seem to imply two entities; and such a supposition involves the notion that the second entity differs from the first simply in being absent and active at night while the other is at rest. Only as this supposed duplicate, once thought of as like the original in all things, becomes gradually modified by the dropping of physical characters irreconcilable with the facts, does the hypothesis of a mental self become established.

It is a notable fact that this belief in the duality of self is constantly found among savages, and that they bring the same forward in explanation of the peculiar states known as swoon, catalepsy, etc., in which animation is suspended—as

well as for sleep. Insensibility following a blow or violent exertion, the Fijian believes, is due to the duplicate self wandering away from the body; and as the desertion is more determined than in the case of sleep, the return of the duplicate is followed by silence as to what has been seen or done in the interval. In our own common speech, we show the way in which syncope yields seeming verification of the primitive notion of duality. We speak of one who revives from a fainting fit as "coming back to himself;" we use the term "absent-minded" or "abstracted," literally meaning drawn away. "Wits gone wool-gathering" is an apt vulgarism in point. All of these terms clearly express the idea of something having departed from the present self, for a time.

In apoplexy, the patient suddenly falling betrays a "total loss of consciousness, of feeling, and of voluntary movement;" there is snoring as in deep sleep. Yet the sufferer cannot be "brought back to himself" by ordinary means, and the savage witnesses such effects, and, recalling his dream experiences, believes that the second self has gone away for a time beyond recall. Some time afterwards there is a like prolonged insensibility, and then revival, and another silence as to what has happened in the interval; on the third time, the absent something does not return.

Similar in the suddenness with which it commences, but otherwise dissimilar, is the state of insensibility called catalepsy. Instantaneous loss of consciousness is followed by a state in which the patient "presents the air of a statue rather than that of an animated being," and control of the members is lost. There is no recollection of occurrences during the attack; and interpreting the facts according to their primary meanings, the wandering other self will give no account of its adventures. The Chippewas, believing in the journeying of souls, think that those of persons in a trance, "being refused a passage, return to their bodies and reanimate them."

There is still another state of insensibility which has shown itself repeatedly of late among persons who have been profoundly impressed by the religious revivals. We refer to ecstasy, in which the subject shows that he is "not himself," and seems to have vivid perceptions of things elsewhere. During this state, in which the muscles are often rigid, and there is a total suspension of voluntary motion, visions of an extraordinary nature occasionally occur. These phenomena tend to strengthen the primitive belief that each man is double. All the various phases of coma, from a state of slight drowsiness up to permanent and profound stupor, are similarly interpretable.

It will be seen, from Mr. Spencer's reasoning before given, that the supposition peculiar to the savage is not without some justification; and if the prevalence of a hypothesis is any support, this is certainly one most widely extended. The Fijian may sometimes be heard to bawl out lustily to his own soul to return to him. Among the Karens, a man is constantly in fear lest his other self should leave him: sickness or languor being regarded as signs of its absence. Among the northern Asiatic tribes, disease is ascribed to the soul's departure. By the Algonquin Indians, a sick man is regarded as having his "shadow" "unsettled or detached from his body." Like interpretations are met with among the Australians and Tartars. A remarkable instance of the survival of the primitive idea that the soul leaves the body during sleep is instanced among certain Jewish sects: where the prayer on awakening is one of thanks for the return of the soul, and an immediate duty is the washing of hands and face to cleanse away the impurities of this minor death.

THE CENTENNIAL SURPLUS.

Congress, prior to the opening of the Centennial, appropriated \$1,500,000 toward defraying the expenses of the same, and provided that, after the debts of the Exhibition had been paid, the United States should be reimbursed before any profits should be distributed among the stockholders. After the Exposition was over, the Centennial Board of Finance declined to refund the above sum to the National Treasury out of the funds on hand, on the ground that the same could be reclaimed by the United States only after the accruing of profits, and that, as no profits had accrued, the Exhibition not having paid expenses, the United States was barred from taking any part of the balance in the hands of the Board, and that said balance was the property of the stockholders and was divisible only among them. Issues were framed, and the controversy put in action in the United States Circuit Court, which rendered decision in favor of the stockholders. The Government then appealed, and the judgment of the Supreme Court, delivered by the Chief Justice, reverses that of the court below, mainly on the ground that the act of 1876 "appropriated moneys to be paid back under certain circumstances, and the accepting of them only by the Board of Finance created a liability to repay it by the act of 1872." The assets of the corporation were to be divided among the stockholders only after the payment of all liabilities; and unless the contract entered into otherwise provides, it is clear the United States must be paid in full before the stockholders can claim distribution among themselves. The million and a half of dollars will therefore be paid into the United States Treasury.

This decision will, it is said, materially affect the interests of the permanent Exhibition in Philadelphia, as the subscription to that enterprise consisted in large part in Centennial stock worth some \$500,000 at par. It was expected that \$300,000 could be realized thereon; but now it seems that its value is but 30 cents on the dollar, so that the available capital, including \$130,000 in cash, amounts to but

about \$280,000. The preparations for opening will not be interrupted, and it is thought that the future income from admissions will be ample to insure the success of the undertaking.

ALLEGED MAGNETO-GRAPHY.

Mr. William Brooks has recently communicated to the South London Photographic Society some astonishing statements (which we find in both the *Photographic News* and the *British Journal of Photography*) regarding impressions which he claims to have obtained in a sensitive plate exposed in total darkness to the influence of a magnet—said impressions being analogous to those due to light. The probabilities are that the investigator has overlooked conditions in his experiments which would give another and more likely cause for his results; and certainly no one will accept the latter according to his interpretation, in the absence of proof of the most convincing and conclusive nature.

Mr. Brooks places a horseshoe magnet, about 8 inches in length, poles uppermost, in a dark box. Over the poles, and about three eighths of an inch distant, he suspends a card blackened with Indian ink on both sides, and pierced with certain letters and geometrical figures. One eighth inch above the card, he places his sensitized plate, so that the latter is thus half an inch distant from the magnet. The exposure lasts from three to fifteen minutes, after which the plate is removed and developed. Where the perforated parts of the card have not intercepted the magnetic *aura*, or influence, or mode of motion, or vibration (the reader may choose his own term), sometimes a negative and sometimes a positive image is developed, as if ordinary daylight had had access to the plate. It will doubtless astonish many to find that a card is capable of intercepting magnetism, as it is currently believed that that natural force acts through all interposed bodies—as would be inventors of magnetic cut-offs have discovered to their confusion. But this is not ordinary magnetism—it is *aura*—the imponderable agent which Reichenbach conceived and supposed to emanate from most substances, and to affect people as well as sensitive plates. Mr. Brooks wisely offers no opinion on the matter; but not content with the remarkable statements already made, he adds that upon his plate appeared a portion of a word, which was not in perforated letters on his card screen. After examining the latter with great care, he discovered that the word was printed on the card, but was illegible except when the card was held at an angle, and then only very faintly, being thickly covered with Indian ink. This spoils a good story by making it too strong. If the card intercepted the magnetic *aura* so that the same could only act through the perforations in the first case, how could the same influence, acting on another part of the card at the same time, go through that card where the printed letters were impressed? And why did it not reproduce all the printing on the card instead of selecting a portion of a word? There is a mysterious discrepancy about it all, which makes us think that Mr. Brooks is a "medium."

REMARKABLE RESULTS OF EVAPORATION AND RAINFALL.

The general belief that all dry land on the earth's surface must necessarily be above the ocean level is erroneous. Land is above the level of the sea only where there is a direct water communication, by the drainage streams of the district, with the ocean. But there are many instances where such a communication does not exist; and in such cases the drained surface may as well be below as above the general ocean level, where there are depressions in the soil. Large regions that are below the ocean level will not necessarily be entirely filled with water, because as a rule the amount of evaporation far surpasses the amount of rainfall. To realize this fact, we have only to consider that one quarter of the terrestrial surface is land and the rest is water; and it is certain that the evaporation from the land cannot amount to much, compared with that from the aqueous surface. It is true that vegetation throws some watery vapor into the air; but so on the other hand vegetation consumes a great deal of water, the elements of which are fixed in the plants. We may assume, therefore, that the evaporation from three quarters of the earth's surface, occupied by ocean and lakes, provides all the water falling on the whole; therefore, as a rule, the evaporation from a given surface of land surpasses the amount of rainfall. The former differs for every climate, but is for each special belt of latitude a much more constant quantity than the amount of rainfall, which, by peculiar local circumstances, such as mountain chains, air currents ascending from arid plains, etc., is often so much interfered with as to leave in some places rainless regions: such districts are the southern extremity of California, and New Mexico, near the mouth of the Colorado river, and there is another in the center of the Mexican Republic, and still another in a very elongated strip of land with its neighboring sea extending along the western coast of South America, from Peru to Chili. A larger surface of this kind is found in Central Asia, in and around the great desert of Gobi or Shamo, situated in Mongolia and Chinese Tartary. But the largest rainless surface is that which extends in Northern Africa, beginning some 300 miles inland from the western extremity, over a width of not less than 1,000 miles in an east by north direction. It covers a large part of Egypt and the surrounding lands, including Arabia, and a narrow belt of it passes through Asia and Persia. In the last named country, a long strip of country, extending some 200 miles on each side of the 70th meridian of longitude east of Greenwich

separates it from the next largest rainless region of Central Asia, mentioned above.

On the other hand, there are a few regions of perpetual rain. These appear to be, as far as they are known, Cape Horn, at the southern extremity of South America, and the neighborhood of Sitka, at the southern part of Alaska Territory, which formerly belonged to Russia, but which now forms part of the United States. It follows, therefore, that over the rest of the earth the fall of rain must be very unequally distributed; and we have compiled a series of observations as follows, which gives the average rainfall per year in inches for several localities.

No. of inches falling per year	Locality.
13	Erfurt, Germany.
16	Cambray, France. Upsala, Sweden.
17	St. Petersburg, Russia. Copenhagen, Denmark. Toulon, France.
18	Brussels, Belgium. Francke, Holland.
19	Stockholm, Sweden.
20	Marseilles, France. Coblenz, Germany. Glasgow, Scotland.
25	Rotterdam, Holland. Strasburg, Germany. Lisbon, Portugal.
30	Funchal, Madeira. Rome, Italy.
35	Liverpool and the Isle of Man, England.
40	Mafra, Portugal. Florence, Italy.
45	Dover, England. Genoa, Italy.
80	Bergen, Norway.
110	Coimbra, Portugal.

At the western limit of the rainless region of Central Asia are situated several lakes, receiving their water supply from rivers; these lakes are without communication with the ocean, but they are all situate on a table land, some of them many hundred feet above the ocean level. But they all dispose of their supply of water by evaporation.

Every such locality forms a water system by itself, surrounded as it is on all sides by mountain ranges, without any local depression to permit the exit of the water; thus all the rain received must necessarily be disposed of by simple evaporation.

When we proceed westward from these lakes of Central Asia, the elevation becomes less and less until we reach the Sea of Aral, which is the largest of these inland seas, covering about 10,000 square miles; its surface has been found to be only 21 feet above the level of the ocean, while our Great Salt Lake in Utah is not less than 4,220 feet above the sea. Proceeding further west, the ground is still more depressed, and gives evidence that a gradual sinking has taken place towards the shores of the Caspian Sea, which at its nearest point is scarcely 100 miles west of the Sea of Aral, but of which the surface is 112 feet below that of Aral, and 86 feet below the level of the ocean. It is the largest body of water in existence which has no communication with the ocean. It separates the southeastern extremity of European Russia from Asia, and it covers a surface of about 100,000 square miles; it is separated by a high mountain chain from Persia, a great portion of which empire is situated in the largest of the four or five rainless belts. This belt extends through the whole of Central Africa and Southwestern Asia, as far as the sources of the river Indus. This sea, therefore, receives no supply of water of any importance from the south; and on its eastern side only one river of any importance empties itself into it. This river is the Attrick, which has its source in the Persian mountain chain mentioned. The western shore receives the waters of several rivers, among which are the Kooma, the Terek, the Koor, the Avan, etc.; but the northern side receives an enormous amount of water from two large rivers, the Volga and the Ural. The first is the largest river of Europe, having a length of 2,300 miles; it drains a surface of not less than 640,000 square miles, more than half the area drained by the Mississippi and the Missouri, and more than the whole of the watershed of the mighty St. Lawrence, which with its chain of large lakes drains a surface of 600,000 square miles. The latter river, the Ural, which belongs as much to Asia as to Europe, forming as it does a part of the southern boundary between the two continents, has a length of some 1,050 miles, and drains a surface estimated to be nearly equal to that of the Caspian Sea. East of the Ural, several other considerable rivers, each about as large as our Hudson, Delaware, or Susquehanna, pour their waters also in the northern extremity of the Caspian Sea; and it is no wonder, therefore, that old geographers, who did not know that its level was below that of the ocean, and who had no idea of the results of powerful evaporation, were unable to account for the disposal of all this mass of water, and so they imagined that there was a subterranean outlet toward the Black Sea or the Persian Gulf. Kircher, in his book on the subterranean world, gives a picture of this supposed channel, traversing at great depth the bases of mountain barriers and passing under the beds of rivers, etc.

These suppositions were definitely set at rest by the discovery that the surface of the Caspian Sea, as before stated, is 86 feet below the surface of the ocean; while the surrounding shores, especially in the north and northeast, extend for many miles as an alluvium, also below the ocean level. These data were ascertained many years ago by the surveys for canals constructed with the intention of establishing water communication between the Caspian and Black Seas by means of a canal uniting the Volga and the Don. At one point these rivers are close together; but the Don flows into the Black Sea, and the Volga, as we have stated, into the Caspian.

The Caspian Sea is a forcible illustration of the fact that the evaporation on a given surface may far surpass the rain-

fall. It receives the drainage of a surface more than ten times its own size; and if we suppose that three fourths of the water falling in rain is utilized by vegetation, and so never reaches the streams, there is still the watershed from two and a half times the Caspian's area, besides the rain which falls in that sea itself, which must be disposed of by evaporation; and such is undoubtedly the case. It is scarcely necessary to go into calculation of the million of tons of water which the Volga and the Ural supply annually—a calculation which offers no difficulty when we consider that the average rainfall on the ground drained by those rivers is nearly 12 inches, making 1 foot of water over a surface of about 1,000,000 square miles; we leave this calculation to our readers, merely drawing attention to the enormous amount of saline matter washed out by this water from the soil through which and over which it flows. This salt is all carried to the Caspian Sea; and as only pure water is removed by evaporation, the salt remains behind, and that body of water must necessarily become more and more salt, up to the point of saturation, which is now nearly reached, the Caspian Sea being already much saltier than the ocean. The rivers continuing to pour in water, of course of less purity than that which evaporates, the process goes on; and this consideration solves not only the question in regard to the salting of this particular lake, but of all lakes having no outlet, and also the question, so often asked: Where does the salt of the ocean come from? The ocean is, in fact, nothing but a huge lake without an outlet, into which all the rivers of the earth continue to pour their impure waters, while nothing but pure distilled water is taken out by evaporation. Even the ocean, therefore, must steadily increase in its saltiness, and only its immense size retards the change which will take several thousand years to become appreciable to man.

A Time Ball in New York City.

An arrangement has been concluded between the Superintendent of the United States Naval Observatory at Washington and the Western Union Telegraph Company, for the purpose of disseminating the standard time, as determined daily by the Naval Observatory, to shipowners and masters, business men in general, railways, chronometer makers, and others, and to the public generally. In pursuance of this agreement, a time ball of large size is to be dropped daily from the tower of the Western Union Telegraph Company's main building at New York city; and arrangements will be made for controlling public clocks in New York and other places, and also for distributing the noon signal of the United States Naval Observatory to various cities in the United States having more than 20,000 inhabitants. In New York, at 11h. 55m., a time ball will be hoisted halfway up the iron flagstaff on the tower of the Western Union building at the corner of Broadway and Dey street. This ball is 3 feet 6 inches in diameter, and can be seen by all the shipping lying at the New York and Brooklyn docks and on the New Jersey shore, as well as by all vessels lying in the bay, even beyond quarantine. For long distances an ordinary ship's glass will be needed. It can also be seen on Broadway from Tenth street nearly to the Battery and from suitable positions it can be seen by a large majority of the citizens of New York, Brooklyn, Hoboken, Jersey City, etc.

The ball will remain at half mast from 11h. 55m. to 11h. 58m. At 11h. 58m. it will be hoisted to its highest point, about halfway up the main staff—that is, over 250 feet above the street. It will be dropped by an electric signal at exactly noon by New York time. The longitude of New York being assumed to be that determined by the United States Coast Survey for the City Hall. 12h. 0m. 0s. 00 New York time=11h. 47m. 49s. 53 Washington time. 12h. 0m. 0s. 00 New York time=4h. 56m. 1s. 65 Greenwich time.

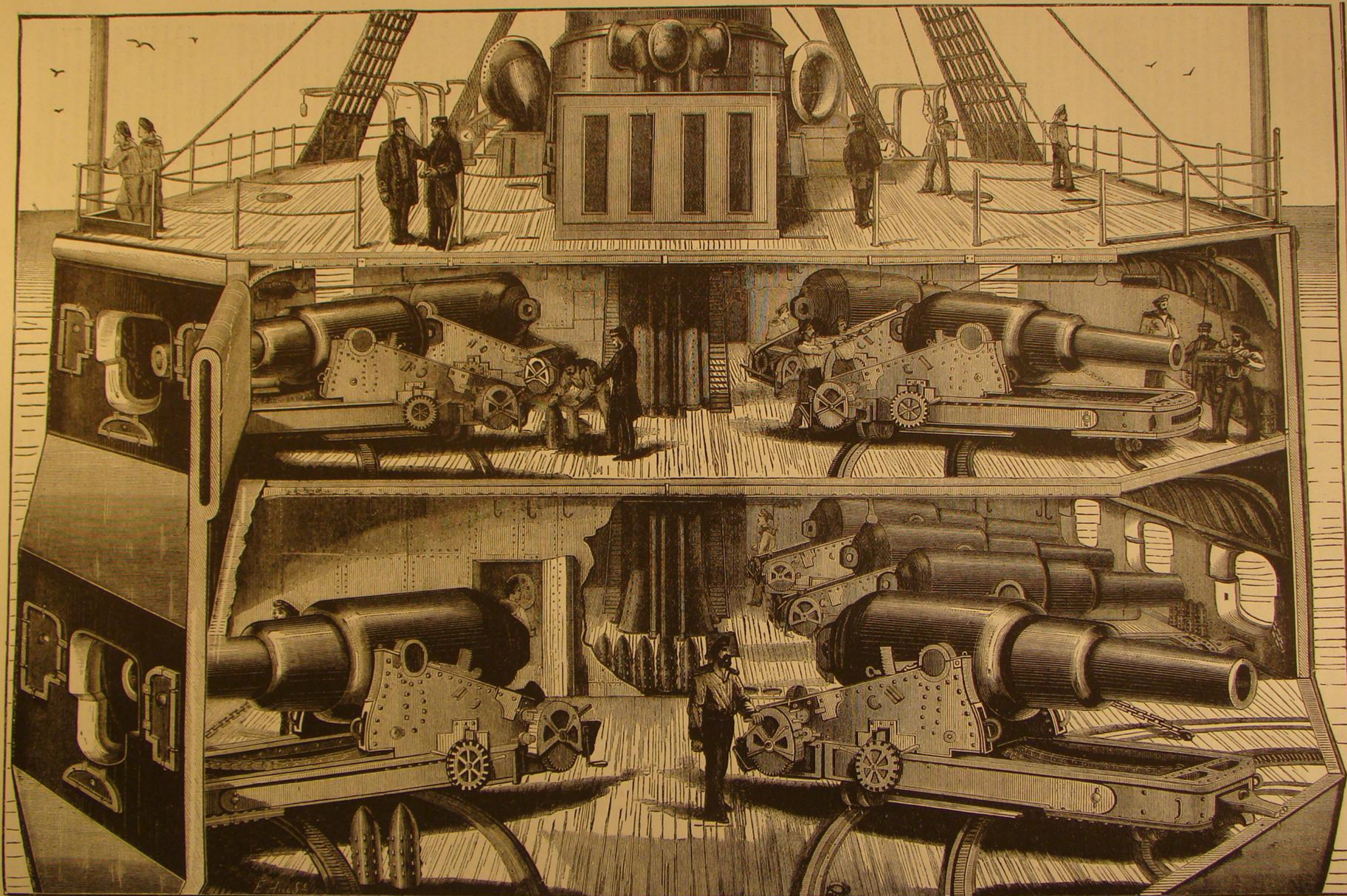
If, on account of high winds, etc., the ball fails to fall at 12h. 0m. 0s., it will be kept at the mast head till 12h. 5m., and then dropped at 12h. 5m. 0s. In such cases, a small red flag will be hoisted at 12h. 1m. and kept flying till 12h. 10m.

The time of falling of the ball will record itself automatically, by electricity, near the standard clock of the Western Union Company (which is regulated by signals from the Washington Observatory); and if by any cause it does not fall precisely at noon, its error will be known. In the evening papers of the day, and in the papers of the next morning, a notice will be regularly inserted, stating whether the ball fell at the correct time, and if not, then its error fast or slow. In this way, even signals which high winds or other causes have prevented from being given precisely will still be available for the regulation of clocks and chronometers.

This ball will therefore serve to regulate the clocks of New York city to standard New York time, and will also serve to correct chronometers of ships lying in the harbor.

Business Stagnation in Germany.

Herr Krupp, of Essen, Germany, the great gun maker, has issued a memorandum to his workmen, dilating on the present stagnation of business, and the short hours necessitated by the restriction of the market. Herr Krupp exhorts his men to submit with patience to the passing slackness and reduced wages, and points to the conduct of the laboring classes in England, under like circumstances, as an example not to be followed. England has had its period of industrial activity and prosperity. "England has grown great and powerful by her industry. Then her working men have formed trades' unions, and struck work for the purpose of enforcing higher wages. The consequence has been that the work of England has, to a great extent, been carried abroad. That ought to be a warning to us."



THE IRONCLAD MAN-OF-WAR ALEXANDRA.—[See page 261.]

STRAIGHTENING SAWS.

In the manufacture of saws, the straightening forms a large proportion of the manipulative processes. The cutting of the teeth, the grinding, the polishing, the tempering, and the finishing: each of these processes is accompanied by a straightening operation; for in insuring an equal amount of tension at all parts of the blade lies one of the principal elements necessary to the production of a good saw, and a blade can hardly have any mechanical operation performed upon it without affecting its tension and straightness. In the use of saws, it is found that band and frame saws are, under ordinary conditions, comparatively easily kept true and straight; whereas hand and circular saws are readily affected by several causes, among which the most prominent is the setting of the teeth. The blades of circular saws, moreover, frequently become hot, and the heating of a blade is almost certain to impair its straightness, and hence the equilibrium of its tension.

The set of a saw tooth should all be given to the tooth itself, and in no case should it extend below the bottom of the tooth into the solid blade; because in that case it affects the straightness of the same and renders it liable to break. The harder any cutting tool is, the more cutting duty it will perform without becoming dull. On the other hand, the strength depends upon the degree of hardness or temper. In a saw, the temper is made to conform to the requirements of strength and elasticity, the latter element including its resistance to becoming bent or taking a permanent set, if bent much out of the straight line; and this degree of temper (which is shown by a blue color) is found to be the highest which it is practicable to give to the saw teeth; which, being formed out of the plate itself, are necessarily of the same temper as the plate. Furthermore, the blue shows the highest temper which it is practicable to give to the teeth, and still allow them the capability of being bent to obtain the set. Indeed, it is only from the fact of their being weakened by the spaces between them that they will permit of being set without becoming broken; for were we to attempt to set the solid edge of a plate or blade, it would break, if properly tempered. If then, in setting saw teeth, we allow the setting to extend below the tooth, the strength of the latter is destroyed, and the straightness of the plate or blade is impaired.

What is commonly called a buckle or a bend in a saw plate is known to the trade as a tight or a loose place, meaning that the want of straightness is produced by parts of the blade being unduly contracted or expanded; and all the efforts of the straightener are directed to the end of removing the contraction or of accommodating the expansion, so that, the unequal tension or strain being removed, the plate will be true and straight. If we take a saw plate that is quite true, and lay it upon a truly planed iron plate and allow it to become first heated and then cooled thereon, we shall find that it has become warped by the process, and it is apparent that the warping has been produced by the expansion and contraction of the plate, and possibly mainly from irregular heating and cooling; for it is impossible to insure that the heat can be imparted to and extracted from the plate equally in all parts. The varying widths, the extra exposure of the teeth due to their partial isolation (and hence their increased susceptibility to heat and cold), and other elements, would all cause inequalities in heating, against which it would be impossible to provide. The circular saw affords the best example of the vicissitudes caused by unequal tension, as well as the most striking instance of the minuteness and skill in mechanical detail required in the saw straightener's art.

Suppose, for example, that we have a circular saw of three feet diameter, and that it is made straight and true, and with an equal degree of tension existing all over it. Let its circumference travel at a speed of 2,500 feet per minute: it is obvious that the centrifugal force generated by the motion will tend (and actually does, to a slight extent) to expand the saw plate, and it is equally obvious that this expansion decreases in amount as the center of the saw is approached. The equality of the tension on the plate is destroyed; and though stiff and true when in a state of rest, the saw is loose on the outside (or, in other words, center-bound) when rotated, the looseness of the plate decreasing from the circumference towards the center as the radius shortens. As a consequence the extreme edge will, when in motion, flop over from one side to the other, according to the side on which the duty offers the most resistance; and this resistance will vary, from the curves in the grain in the wood, from knots, and from a variety of more minute causes. It follows, then, that the sawing cannot be smooth, and that, as the saw bends or flops over on one side, the opposite side of the blade will come into close contact with the work, entailing friction and, as a result, heating; the latter will cause the saw to dish, and to remain permanently dished.

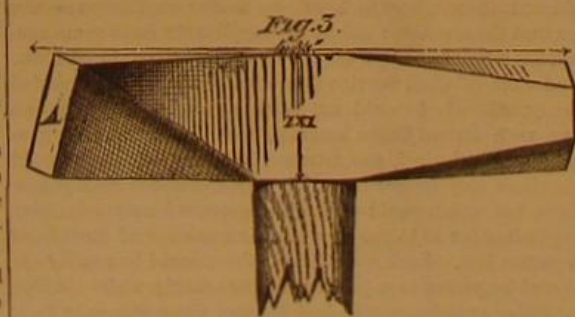
The method employed by the saw straightener to compensate for the expansion due to the centrifugal motion is to place upon the saw a tension insufficient to dish the saw when at rest, and yet sufficient to accommodate the expansion due to the centrifugal force. This he does by the delivery of blows upon the plate, the effect of which will be to create a tension sufficient to tend to enlarge the plate without overcoming the resistance to enlargement offered by the plate itself until such time as the centrifugal force diminishes this resistance: when the tension follows up the advantage afforded by the centrifugal force, and holds the plate from becoming loose on its outer circumference. If from an error of judgment the tension is insufficient to accommodate the centrifugal force, the saw becomes loose in the middle, or,

in other words, it becomes rim-bound when in motion; and the result is that it dishes, as shown in Fig. 1. So that one side contacts with the work; and if the saw teeth meet with different resistances on its two sides (which may occur from the waves in the grain of the timber, or from other causes), the dish will jump from one side to the other of the saw, because, from being rim-bound, it is impossible that it remain straight. And as soon as it is forced

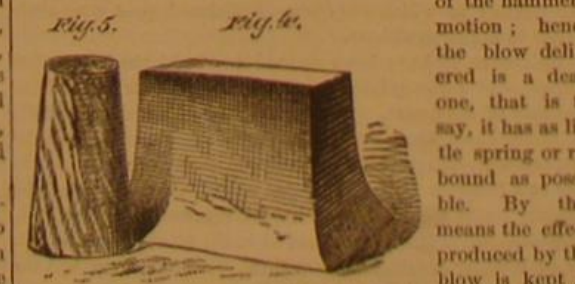
over the straight line, it springs to the dished form, which is the only one capable of accommodating the tension. Now when it is remembered that cutting out the metal to form the teeth weakens the saw, rendering it more susceptible to expansion from the centrifugal force, and that the number and the depth of the teeth, and the temper, thickness, and size of the saw, as well as the speed at which it rotates, are all elements tending to vary the force and effect of the centrifugal motion, it will be readily perceived that it requires unusual judgment and skillful manipulation to enable the workman to give to a saw the exact amount of tension called for by the particular circumstances under which it is to operate. Yet so skillful are some of the straighteners that they have been known to remedy a defect in a saw from the delivery of a single light blow.

The blows delivered are in no case quick ones, nor are they sufficient to leave an indentation or impression upon the saw blade or plate. Each is given with a view either to create or remove tension, and not to give to the metal a permanent set; and although in explaining the method of manipulation it will be necessary to show, in the illustrations, the hammer marks, it is to be understood that those marks are not visible upon the work, and are only employed to denote where the blows were delivered.

In Figs. 2 and 3 are shown the hammers used by the saw straighteners. The first is called a "doghead." Its weight is about 3 lbs., its diameter is about 1½ inches, and its length is about 5½ inches. Its handle which is about 14 inches long, stands at an angle of 85° to the body of the hammer. Its face is round, and of an even sweep. That shown in Fig. 3 is called a blocking hammer; the face at A is slightly rounded. In Figs. 4 and 5 are presented the straightening blocks; that shown in Fig. 4 is of iron faced with steel. The face is bright, smooth, and slightly rounded. Fig. 5 represents a wooden block upon which the straightening of the finished saws is performed.



The doghead hammer, Fig. 2, is used mainly for stretching, that is, for removing a tension. The reason for its handle being at an angle is that by this means the handle of the hammer stands, when the blow is delivered, in the line of the hammer's motion; hence the blow delivered is a dead one, that is to say, it has as little spring or rebound as possible. By this means the effect produced by the blow is kept at a maximum; and



the speed of the hammer being comparatively slow, it does not leave hammer sinks or marks upon the saw plate or blade.

The part of the saw plate being operated upon must always be kept flat upon the anvil, so that the blows will be received on a solid; otherwise they would distort the blade by bending it instead of stretching it. The motion of the doghead hammer, shown in Fig. 2, is sometimes such that it strikes the plate or blade fair, so that its effects extend equal-

ly in all directions, as shown in Fig. 6, at A, in which the dark center shows where the hammer fell, and the radiating lines denote the stretching effects of the blow. At other times, the direction in which the hammer falls is aslant, as shown in Fig. 6, at B, in which the hammer, while falling, travels also in the direction denoted by the arrow, C, the stretching effects of the blow being denoted by the radial lines around the center, at B. The motion of the hammer, however, is never varied so as to travel towards, but always away from, the operator, the saw (if not a circular one) being turned end for end upon the straightening block when necessary.

The method of using the blocking hammer, shown in Fig. 3, is as follows: The shape of the face of the hammer, in conjunction with the line of motion in which it falls, determine the direction in which the effects of the blow shall extend. If, for example, the face, A, of the blocking hammer were flat, and the blow fell vertically true, the effect of the blow would radiate equally on all sides of the spot which received the blow. If, however, the face, A, of the blocking hammer, while falling, traveled also laterally, the effects of the blow will be greatest on the side towards which the lateral travel took place. Thus, in Fig. 7, if the hammer, in falling, traveled from B towards the hammer mark shown,

the effect of the blow would be as denoted by the radial lines; while if the position of the hammer face were turned to a right angle, and a blow were struck with the hammer traveling

laterally from C towards the hammer mark shown, the effects upon the plate would be in the direction denoted by the radial lines, shown at C. The curve of the face of the blocking hammer, at A, also has an influence in extending the effects of the blow forward; and the result of these combined elements is that the blows lift the plate in front of them, so that, if blows were delivered as shown in Fig. 8, at A, the plate would bend upwards, assuming the shape denoted by the dotted lines at that end; while by blows delivered in the direction indicated by the marks at B, the plate

or blade would curl up, as shown by the dotted lines at that corner of the plate.

A saw plate or blade may have a bend in it that is not discernible to the unpractised eye; and yet the expert workman will readily detect the defect as the saw lies upon the straightening block; and all the coarser defects can be attacked and remedied without sighting the plate at all. But when the finer part of the straightening is to be performed, and the tension of the blade, as well as its straightness, is to be perfected, the workman casts his eye along the blade nearly in a line with its length, when, the light coming in front of the operator, any unevenness upon the blade will be denoted by shadows, as shown in Fig. 9, which represents

an ordinary handsaw being sighted, the shadows showing the want of straightness. Having detected the part of the blade which is out of true, the workman reverses the position of the blade, holding it in his hands as shown in Fig.



10, and he then bends the plate slightly backwards and forwards, the object of which is as follows: The defects in the

Fig. 10.



plate exist by reason of some part being either unduly expanded or contracted, thus creating undue local tension in one place, and removing the natural tension in another. The workman, when bending the plate backward and forward, finds that the loose place (or, in other words, the expanded part) moves easily, while the contracted part offers a resistance to the bending movement; so that, by noticing the amount of the movement during the bending, the workman discovers where the contracted part is, and he proceeds to remove it by stretching the blade in that spot. Thus while straightening the blade its tension is also equalized, giving to the plate a uniform resistance to its becoming bent or sprung. During the hammering process, the straight edge is frequently applied to the blade as a guide to test the work by. If, while attacking the necessary places, the saw blade does not lie solid upon the straightening block, the hammer will drum, as it is called; and the effect of the blow will be to stretch the outside skin of the saw blade, causing it to rise up because of its being elongated. Thus, were the blade to be hammered all over one face without bedding solid on the block, it would become bow-shaped, the face struck being the convex side.

In Fig. 11 is shown a saw blade having a loose place in the

Fig. 11.

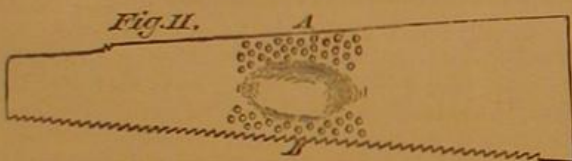
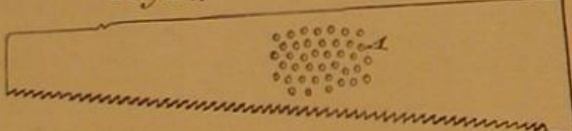


Fig. 12.

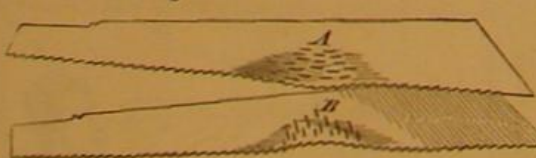


middle, as denoted by the shade shown upon the face. The method of attack here would be to deliver the blows denoted by the marks shown at A and B, using the doghead hammer for the purpose. The parts so struck would be stretched, giving room for the loose place to flatten, and taking the undue tension from the outer surface and imparting it to the loose place, the saw becoming slightly elongated by the process. If, however, the bending process or test showed the contraction to be in the middle of the blade, the doghead would be used to deliver the blows shown in Fig. 12, at A, which would stretch the metal there, removing the contraction and equalizing the tension. Suppose, however, that the saw was atwist, as shown in Fig. 13: the method of attack

Fig. 13.



Fig. 14.



would be to take the blocking hammer, and deliver the blows denoted by the marks shown, using the hammer so that, while falling, it would travel laterally slightly from the workman. The blade would be placed upon the block with the drooping side downwards, because the effect of the blows of the blocking hammer is, as before noted, to lift the plate in front of them.

If one edge of the saw blade had a kink or wave in it, as shown in Fig. 14, the method of procedure would be as follows: The blade would be placed upon the block with the hollow side of the kink downwards, as shown in Fig. 14, and the blows shown at A would be delivered. The effect of these blows will be to stretch the metal of the plate, removing the tension behind the kink, and producing a tension tending to lift the part kinked. The plate is then turned

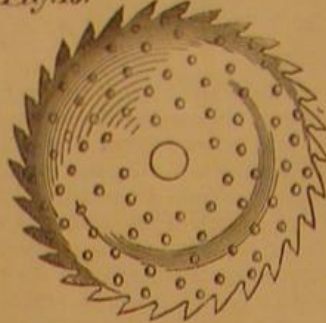
upside down, and the blows denoted by the marks shown in Fig. 14, at B, are delivered, which will remove the kink.

In performing any one of these operations new contractions or expansions of parts may be induced; and it not unfrequently happens that a kink and a twist, or a twist and a loose place, may be attacked at the same time. Numerous combinations of contracted or expanded places may of course exist in a blade, and the process for removing one may be modified or carried on in conjunction with that necessary to remove another; the principles employed, however, are in all cases those explained above, the application being varied to suit the circumstances.

In the edge view of Fig. 15 is shown a circular saw dish; and here it may be noted, that in this case as well as when the saw is out of straight, the first thing to do is to get the dish out, and afterwards proceed with the straightening. To remove the dish, the saw is placed upon the block with the concave side uppermost; and the blows are delivered with the doghead in the places denoted by the marks shown on the face view of the saw in Fig. 15. The testing of the saw is made by bending it, by sighting it, and by applying a straight edge to its surface. Some circular saws are too thick and strong to be easily bent, and in that case the bending test is omitted. If a circular saw is atwist or has a kink in it, the method of attack is the same as that already described for similar defects in hand or frame saws: except that, as before explained, a slight tension is left upon the outer diameter so as to allow for the expansion of the saw created by the centrifugal motion and force.

J. R.

Fig. 15.



Communications.

Our Washington Correspondence.

To the Editor of the Scientific American:

The letter of the Commissioner of Patents to the Secretary of the Interior on the general management of the Patent Office has been followed by a meeting of the different heads of bureaus of the Interior Department, for a general interchange and comparison of views and a discussion of the reports submitted by them upon the subject of civil service reform as applicable to the department. General Spear earnestly advocated the system of competitive examination, which prevailed in the Patent Office for several years before it was ignored by Secretary Chandler from the failure of Congress to provide means of paying the Civil Service Commission. It is to be hoped that competitive examination will again be the rule in making appointments, instead of the question as to a man's usefulness as a politician, as the examinations formerly made undoubtedly led to a great improvement in the examining corps during the time the system was in force. But in forming a new set of rules to govern the competitive examinations, should this system be adopted, those who will have the matter in charge should see that the questions asked the applicants have some connection with the duties they will be called on to perform. Under the old Civil Service Commission a large proportion of the queries asked would not have the least possible connection with Patent Office business, such, for instance, as geographical, historical, and astronomical questions, that would have been very proper if put to applicants for pedagogueships, but which could not, when answered correctly, give any indication as to the answerer's knowledge of mechanics or patent law. Such questions as these could be readily answered by young men just fresh from school; while old Patent Office examiners, who had learned these things in their youth, but in the course of acquiring the requisite knowledge of the classes of inventions under their charge had forgotten them, had, consequently, to take back seats, and see beardless youths who did not possess a tithe of their technical knowledge, and who in some cases actually knew nothing of the classes to which they were appointed, pass over their heads to higher positions.

Bids were to have been opened to-day at the Post Office department for supplying postal cards for four years from the first of May next. The advertisement required the bids to be for cards conformable to the sample furnished by the department, and this sample was one with different tints to the two faces—a buff and a pale green. A number of the leading paper manufacturers having represented to the Postmaster-General that this would virtually establish a monopoly in bidding, as but two or three manufacturers had the machinery necessary for this kind of paper, and that the result would be that the department would be compelled to pay a larger amount for the cards, the Postmaster-General decided to reject all bids, and to call for new proposals for a card such as can be made by any first class paper maker.

The Agricultural Department is continually troubled with applications for seed; but its distribution has ceased for the season, except to those districts of the West which were afflicted by grasshoppers in 1876, and for which a special appropriation was made by Congress a short time before the close of the session. Applications from other sections can-

not therefore be responded to, and parties outside of the grasshopper districts will save time and trouble by not making application.

Congress last session appropriated \$18,000 for the purpose of sending a commission to investigate the grasshopper plague, and suggest remedies for the relief of the suffering farmers whose crops have been yearly devastated by this rapacious insect. The President has appointed Professor C. V. Riley, State Entomologist of Missouri; Professor Cyrus Thomas, Entomologist of Illinois; and Professor Packard, of Salem, Mass., as the Commission. This action is the result of a conference held in Nebraska by the Governors and prominent men of the States and Territories interested, in which Professors Riley and Thomas each took a prominent part. The commission is an excellent one, and will probably make a report of great value. They propose to go as far west as the breeding places of the insect, and study its habits, and from them deduce a plan for its destruction, if possible. The Southern farmers are reported as grumbling at the neglect of their section, and ask: If the grasshopper is to be investigated, why should not the habits of the tobacco or cotton worm be examined by a commission also? They think they have as much right to a commission as the Western agriculturists.

Washington, D. C.

OCCASIONAL.

[For the Scientific American.]

IMPORTANT OBSERVATIONS ON THE ROCKY MOUNTAIN LOCUST, OR "GRASSHOPPER" PEST OF THE WEST.

BY PROFESSOR C. V. RILEY.

In a few weeks the ravages of the Rocky Mountain locust (*caloptenus spretus*) will, in all probability, be creating more attention than ever, as the area threatened by the young insects is larger than ever before, beginning in Southeastern Dakota, including the Southwestern half of Minnesota, the Western half of Iowa, 4 counties in Northwest and 12 in Southwest Missouri, Benton County in Arkansas, Texas from that point to the mouth of the Sabine river, thence along the Gulf to Austin, and more or less all the country west of these points to the mountains. In view of this probability, the following observations, which are largely extracted from my ninth report, now going through the press, and which are here recorded for the first time, will doubtless prove of interest to your large circle of readers: I propose to follow them with the results of a series of experiments on the eggs and the young insects, with a view of most effectually destroying them, which experiments these observations will render more intelligible.

DOES THE FEMALE FORM MORE THAN ONE EGG MASS?

Whether the female of our Rocky Mountain locust lays her full supply of eggs at once, and in one and the same hole, or whether she forms several pods at different periods, are questions often asked, but which have never been fully and definitely answered in entomological works. It is the rule with insects, particularly with the large number of injurious species belonging to the *lepidoptera*, that the eggs in the ovaries develop almost simultaneously, and that when oviposition once commences it is continued uninterruptedly until the supply of eggs is exhausted. Yet there are many notable exceptions to the rule among injurious species, as in the cases of the common plum curculio and the Colorado potato beetle, which oviposit at stated or irregular intervals during several weeks or even months. The Rocky Mountain locust belongs to this last category; and the most casual examination of the ovaries in a female taken in the act of ovipositing will show that, besides the fully formed eggs being then and there laid, there are other sets, diminishing in size, which are to be laid at future periods. This, I repeat, can be determined by any one who will take the trouble to examine a few females when laying. But just how often, or how many eggs each one lays, is more difficult to determine. With *spretus*, I have been able to make comparatively few experiments, but on three different occasions I obtained two pods from single females, laid at intervals of 18, 21, and 26 days respectively. I have, however, made extended experiments with its close congeners, *femur rubrum* and *atlantis*, and in two cases with the former have obtained four different pods from one female, the laying covering periods of 58 and 62 days, and the total number of eggs laid being in one case 96, and in the other 110. A number of both species laid three times, but most of them—owing perhaps to their being confined—laid but twice. They couple with the male between each period, and I have no doubt but that, as in most other species of animals, there is great difference in the degree of individual prolificacy.

I have frequently counted upward of a hundred ova in the ovaries of *spretus*, and as the largest and most perfect pods seldom contain more than thirty, we may feel confident that the Rocky Mountain locust will sometimes form as many as four pods, and perhaps even still more.

The time required for drilling the hole and completing the pod will vary according to the season and the temperature. During the latter part of October, or early in November last year, when there was frost at night and the insects did not rouse from their chilled inactivity till 9 o'clock A.M., the females scarce had time to complete the process during the four or five warmer hours of the day; but with higher temperature not more than two or three hours would be required.

HOW THE EGGS ARE LAID.

The question as to how best to treat the soil, or to manage the eggs so as to most easily destroy their vitality, is a most

important and practical one; and as assisting to a decisive answer, I have carried on a series of experiments which will be presently detailed. To make the experiments more intelligible, I will first give the reader a deeper insight into the philosophy of the processes of egg-laying and of hatching than I have hitherto done, and this the more readily that it has never been given by any other author.

I have already explained (Report VII, page 122) how, by means of the horny valves at the end of her abdomen (Fig. 1), the female drills a cylindrical hole in the ground in which to consign her eggs. The curved abdomen stretches to its utmost for this purpose, and the hole is generally a little curved and is always more or less oblique. (Fig. 2, *e, d*.) If we could manage to watch a female during the arduous work of ovipositing, we should find that, when the hole is once drilled, there commences to exude at the dorsal end of the abdomen, from



Fig. 2.



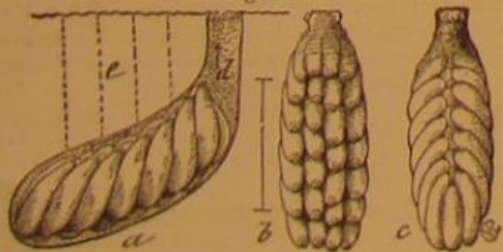
ROCKY MOUNTAIN LOCUST.—a, a, a, female laying; b, egg-pod partly broken; c, loose eggs; d, burrow showing oviposition; e, completed pod; f, covering to one.

a pair of sponge-like exsertile organs (Fig. 3, *a*) that are normally retracted and hidden beneath the super-anal plate near the cerci (Fig. 3, *a*), a frothy mucous matter, which fills up the bottom of the hole. Then, with the two pairs of valves brought close together, an egg would be seen to slip down the oviduct (*j*) along the ventral end of the abdomen, and, guided by a little, finger-like style (*g*), pass in between the horny valves (which are admirably constructed, not only for drilling, but for holding and conducting the egg to its appropriate place), and issue at their tips amid the mucous fluid already spoken of. Then follows a period of convulsions, during which more mucous material is elaborated, until the whole end of the body is bathed in it—when another egg passes down and is placed in position. These alternate processes continue until the full complement of eggs are in place, the number ranging from 20 to 35, but averaging about 28. The mucous matter binds all the eggs in a mass, and when the last is laid, the mother devotes some time to filling up the somewhat narrower neck of the burrow with a compact and cellulose mass of the same material, which, though light and easily penetrated, is more or less impervious to water, and forms a very excellent protection. (Fig. 4, *d*.)



Fig. 3. Oviposition of the Rocky Mountain Locust. a, a, a, female laying; b, egg-pod partly broken; c, loose eggs; d, burrow showing oviposition; e, completed pod; f, covering to one.

Fig. 4.



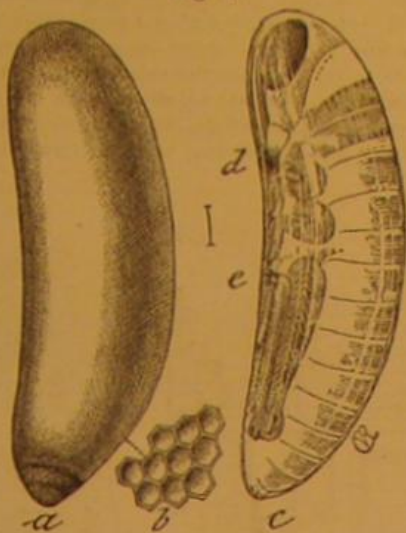
EGG MASS OF ROCKY MOUNTAIN LOCUST.—a, from side; b, from beneath; c, from above—enlarged.

PHILOSOPHY OF THE EGG MASS.

To the casual observer the eggs of our locust appear to be thrust indiscriminately in the hole made for their reception. A more careful study of the egg mass or egg pod will show, however, that the female took great pains to arrange them, not only so as to economize as much space as possible consistent with the form of each egg, but so as to best facilitate the escape of the young locust; for as the bottom eggs were the first laid, and are generally the first to hatch, their issue would, in their efforts to escape, disturb and injure the other eggs, were there no provision against such a possibility. The eggs are, indeed, most carefully placed side by side in four rows, each row generally containing seven. They oblique a little crosswise of the cylinder. (Fig. 4, *a*.) The posterior or narrow end which issues first from the oviduct is thickened and generally shows two pale rings around the darker tip (Fig. 5, *a*). This is pushed close against the bottom of the burrow, which, being cylindrical, does not permit the outer or two side rows to be pushed quite as far down as the two inner ones; and for the very same reason

the upper or head ends of the outer rows are necessarily bent to the same extent over the inner rows—the eggs when laid being somewhat soft and plastic. There is, consequently, an

Fig. 5.



EGG OF ROCKY MOUNTAIN LOCUST.—a, sculpture of outer shell; b, same more enlarged; c, with the outer shell removed, just before hatching; d, points where the shell is ruptured.

irregular channel along the top of the mass (Fig. 4, *c*) which is filled only with the same frothy matter which surrounds each egg, and occupies all the space in the burrow not occupied by the eggs. The whole plan is seen at once by a reference to Fig. 4, which represents, enlarged, a side view of the mass within the burrow (*a*) and a bottom (*b*) and top (*c*) view of the same, with the earth which adheres to it removed.

HOW THE YOUNG LOCUST ESCAPES FROM THE EGG.

Carefully examined, the egg shell is found to consist of two layers. The outer layer, which is thin, semi-opaque, and gives the pale cream-yellow color, is seen, by aid of a high magnifying power, to be densely, minutely, and shallowly pitted; or, to use still more exact language, the whole surface is netted with minute and more or less irregular, hexagonal ridges (Fig. 5, *a, b*). The inner layer is thicker, of a deeper yellow, and perfectly smooth. It is also translucent, so that, as the hatching period approaches, the form and members of the embryo may be distinctly discerned through it. The outer covering is more easily ruptured and is rendered all the more fragile by freezing; but the inner covering is so very tough that a very strong pressure between one's thumb and finger is required to burst it. How, then, will the embryo, which fills it so completely that there is scarcely room for motion, succeed in escaping from such a prison? The rigid shell of the bird's egg is easily cracked by the beak of its tenant; the hatching caterpillar, curled within its egg shell, has room enough to move its jaws and eat its way out; the egg coverings of many insects are so delicate and frail that the mere swelling of the embryo affords means of escape; those of others so constructed that a door flies open or a lid lifts up by a spring, whenever pressure is brought to bear; in some, two halves open, as in the shell of a muscle; whilst in a host of others the embryo is furnished with a special structure, called the egg burster, the office of which is to cut or rupture the shell, and thus liberate its occupant. But our young locust is deprived of all such contrivances, and must use another mode of exit from its tough and sub-elastic prison. Nature accomplishes the same end in many different ways. She is rich in contrivances. Every one who has been troubled by it must have noticed that the shanks (tibiae) of our locust, as of all the members of its family, are armed with spines. On the four anterior legs these spines are inside the shank; on the long, posterior legs, outside. The spines of the hind shanks are strongest, and the terminal ones, on all legs, stronger than the rest. There can be no doubt that these spines serve to give a firm hold to the insect in walking or jumping; but they have first served a more important pre-natal purpose.

When fully formed, the embryo is seen to lie within its shell, as at Fig. 5, *c*. The antennae curve over the face and between the jaws, which are early developed, and with their sharp black teeth, reach on to the breast. The legs are folded up on the breast, the strong terminal hooks on the hind shanks reaching toward the mesosternum.

Now, the hatching consists of a series of undulating contractions and expansions of the several joints of the body, and with this motion there is slight but constant friction of the tips of the jaws and of the sharp tips of the tibial spines, as also of the tarsal claws of all the legs, against the shell, which eventually weakens between the points *d* and *e*, and finally gives way there. It then easily splits to the eyes or beyond, by the swelling of the head. By the same undulating movements the nascent larva soon works itself entirely out of the egg, when it easily makes its way along the channel already described without in the least interfering with the other eggs, and finally forces a passage way up through the mucous filling in the neck of the burrow. (Fig. 4, *d*.) Once fully escaped from the soil, it rests from its exertions, but for a short time only. Its task is by no means complete: before it can feed or move with alacrity, it must molt a pellicle which completely incases every part of the body. This it does in the course of three or four minutes, or even less, by a continuance of the same contracting and expanding move-

ments which freed it from the earth, and which now burst the skin on the back of the head. The body is then gradually worked from its delicate covering until the last of the hind legs is free, and the exuvium remains, generally near the point where the animal issued from the ground, as a little, white, crumpled pellet. Pale and colorless at first, the full-born insect assumes its dark gray coloring in the course of half an hour. From this account of the hatching process, we can readily understand why the female in ovipositing prefers compact or hard soil to that which is loose. The harder and less yielding the walls of the burrow, the easier will the young locust crowd its way out.

The covering which envelops the little animal when first it issues from the shell, though quite delicate, undoubtedly affords protection in the struggles of birth from the burrow; and it is an interesting fact that, while it is shed within a few minutes of the time when the animal reaches the free air, it is seldom shed if, from one cause or other, there is failure to escape from the soil, though the young locust may be struggling for days to effect an escape.

While yet enveloped in this pellicle, the young animal possesses great forcing and pushing power, and, if the soil be not too compact, will frequently force a direct passage through the same to the surface, as indicated at the dotted lines, Fig. 4, *e*. But it can make little or no headway, except through the appropriate channel (*d*), where the soil is at all compressed. While crowding its way out, the antennae and four front legs are held in much the same position as within the egg, the hind legs being generally stretched. But the members bend in every conceivable way, and where several are endeavoring to work through any particular passage, the amount of squeezing and crowding they will endure is remarkable. Yet if, by chance, the protecting pellicle is worked off before issuing from the ground, the animal loses all power of further forcing its way out.

THE BRITISH IRONCLAD ALEXANDRA.

On page 258, we present a fine sectional view of a vessel that is now one of the strongest in the English navy. Judging by the past history of ironclad ships, in a very few years hence the Alexandra will be deemed weak, or else withdrawn from service altogether, adding another to the long list of armored vessels which have been set aside as useless because of the progress made in the construction of artillery capable of perforating their plates. Even now the heavy Krupp guns and the 100-ton English cannon not only pierce 12-inch iron plating, which is the thickest carried by the Alexandra, but send their bolts through two plates of that thickness separated by 9 inches of solid oak. It will be seen, therefore, that against such weapons the sides of the Alexandra offer little resistance, and that the ship before such artillery is practically as vulnerable as a wooden frigate. Nor are there any vessels now afloat which can oppose the shot of the 100-ton gun successfully. The Inflexible, now the most powerful of British ironclads, has 24 inches of plating, and the Dandolo and Duilio, new Italian ironclads, nearly the same; yet the recent trials of the great cannon above mentioned, at Spezia, show that targets representing sections of these vessels were quickly destroyed. The ironclad of the near future must carry either the 40-inch plates which Sheffield makers have promised to roll, or else be incased in steel; for steel armor, it now appears, has offered the best resistance to the shot of the 100-ton gun. The thickest armor of the Alexandra, the belt at her water line, is the 12-inch plating referred to. About her batteries the iron is only 8 and 5 inches thick, so that the men at the guns and the guns themselves are virtually unprotected against shot from modern artillery of even moderate weight.

Though laboring under a great disadvantage in point of vulnerability, the Alexandra embodies some of the newest and most important improvements in naval construction. She is a central battery ship, and is able to train four guns, including the two heaviest of her armament of twelve, straight ahead and two straight astern. This capability is of the greatest moment, since the vessel thus has a range of fire around the entire horizon.

The section of the ship given in our engraving is taken through the battery, showing the two gun decks. The sills of the ports of the lower deck are 9 feet, and those of the upper deck ports 17 feet above the water. The guns are of the Fraser pattern, and are constructed of steel tubes surrounded by coils of wrought iron increasing in number and thickness toward the breech. There are two 25-ton and ten 18-ton guns. The Alexandra is an ocean-going cruiser, and is now flagship of the British Mediterranean squadron. Her dimensions, etc., are as follows: Length between perpendiculars, 225 feet; extreme breadth, 63 feet 8 inches; depth of hold, 18 feet 7½ inches; tonnage, 6,049; displacement, 9,493 tons; draught forward, 26 feet; indicated horse power, 8,000; speed per measured mile, 16 knots.

A MARBLE statue of Sir William Fairbairn has now been completed. The statue, which is to stand in the new Town Hall, Manchester, England, is eight feet high, and represents Sir William standing with papers in his hand as if delivering an address to a scientific audience; the head is bare and slightly inclined, and the statue is an admirable likeness, in the features as well as in the thoughtful expression and quiet energy characteristic of the man.

STATISTICS show that about 250,000 barrels of apples were exported from America last year to Europe. More than half this quantity was sent to England, and about 11,000 barrels went to St. Petersburg.

A NEW HYDRAULIC ENGINE.

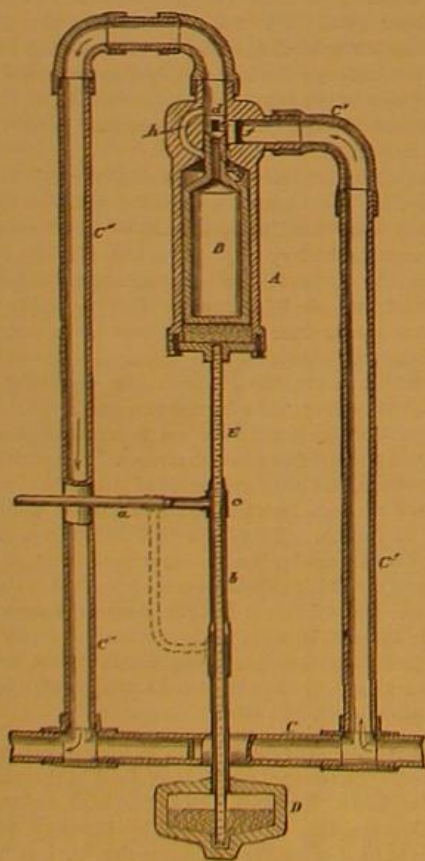
We frequently receive queries from farmers relative to some simple motor adapted to pumping water from a stream and delivering it through pipes to the barn or dwelling. We usually recommend a windmill for this purpose, but in cases where that cannot be advantageously used, a small engine driven by the current of the stream may prove available. Such a motor is illustrated in the accompanying engraving. It was patented through the Scientific American Patent Agency, February 6, 1877, by Mr. Joseph D. Richardson, of Wheeler's Mills, Ky.

A, Figs. 1 and 2, represents a water wheel of any suitable construction, preferably an overshot wheel. The shaft of the water wheel, A, turns in bearings of a supporting frame, B, and intermeshes, by a pinion, *a*, with the gear wheel, *b*, of an intermediate shaft, *d*, which transmits again the power by a pinion, *e*, to a gear wheel, *f*, that is placed, by its sleeve, *g*, loosely on the pump-operating crank shaft, C. A flywheel, C', of considerable weight and size, is keyed to shaft, C, and thrown into operation by a spring, D, which is attached to the loose gear wheel, *f*, and, by its inner end, to the crank shaft, C. The rotation of the water wheel causes the turning of the spring-acted wheel, *f*, until the power stored up in the spring is sufficient to overcome the resistance of the crank shaft, so as to revolve the same and operate the pump, E, assisted by the flywheel. If the flywheel is not large enough, a brake, C'', Fig. 3, may be used, which engages, by its hook-shaped end, studs, *g*, of the flywheel, and retains the same until the brake is released by a pin, *h*, on the sleeve of the gear wheel, *f*. The pin, *h*, bears on a spring-acted lever arm of the brake, so as to lift the same and admit thereby the turning of the crank shaft and flywheel. As soon as the contact of stud, *h*, and the brake arm is terminated, the brake is carried down again on the flywheel, and the power of the water wheel is again stored up by the spring until another full revolution of the wheel, *f*, is completed, and thereby the flywheel again released and the pump worked, and so on.

The power of the stream is thus utilized by being stored up by the spring, and intermittently applied to work the pump, furnishing thereby a supply of water to the house situated on elevated ground above.

MARTIN'S GAS REGULATOR FOR STEAM BOILERS.

This invention is a gas regulator for controlling the supply of gas used in steam boilers as fuel. D, in the engraving,



ing, is a mercury chamber, which is connected with the steam room of the boiler by means of the pipes, *a* *b*, and into which a pipe, E, passes. There is sufficient space between the pipes, E and *b*, to form an open passage between the mercury chamber, D, and the steam room of the boiler. The pipe, E, extends upward, and is connected with a float cham-

ber, A, that contains the float, B. Upon the upper end of the float chamber, A, a valve seat, *d*, is formed, in which the supply ports, *e* *e*, are made, which connect with a semi-annular passage, *f*, provided in the upper part of the casting of the chamber. A valve, *g*, is formed upon the upper end of the float, B, which is cylindrical and beveled downward toward its center, forming a sharp edge, which removes deposits made by the gas upon the valve seat. A passage, *h*, connects the space above the valve seat with the chamber, A, for the purpose of equalizing the pressure on the valve, *g*. C is a gas supply pipe, that leads directly to the boiler

Fig. 1.

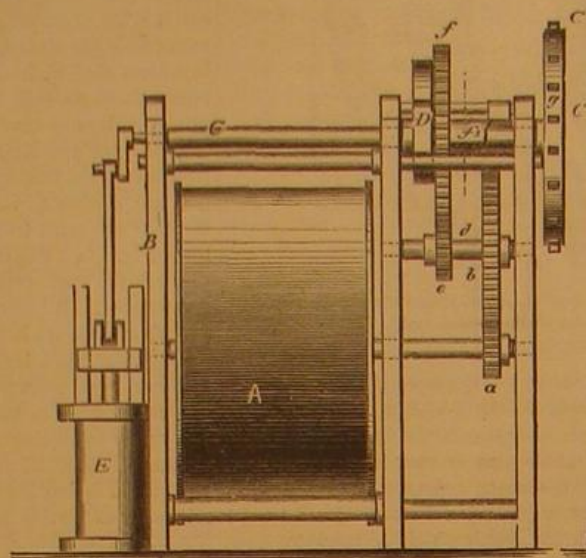


Fig. 2.

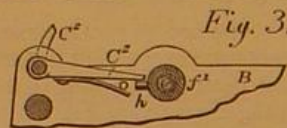
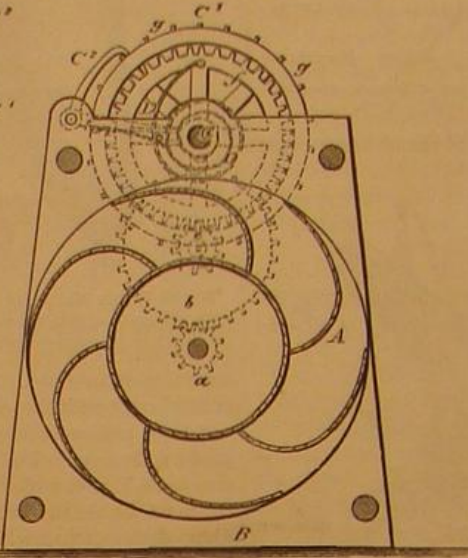


Fig. 3.

RICHARDSON'S HYDRAULIC ENGINE.

furnace, and C' is a branch pipe leading to the supply ports, *e* *e*, of the regulator. C'' is a pipe leading from the gas regulator to the pipe, C. Stopcocks are placed in these pipes, by which the gas may be entirely shut off from the regulator, if required. The pipe, *a*, is connected with the boiler, so that the pressure upon the surface of the mercury contained in the chamber is the same as that carried by the boiler. The length of the pipe, E, is such that the column of mercury contained by it is counterbalanced by the pressure upon the surface of the mercury in the chamber, D. The pipe, C, is stopped between the pipes, C' and C'', and the gas flows through the pipe, C', through the ports of the regulator and pipe, C'', to the boiler furnace. If the supply of gas is too great, an increase of pressure in the boiler results, and an increased pressure is exerted upon the surface of the mercury in the chamber, D, which drives the mercury through the tube, E, into the float chamber, A, which raises the float, B, and causes the valve, *g*, to close the ports, *e*, more or less, allowing only enough gas to pass to the boiler furnace to maintain the required boiler pressure. When the pressure in the boiler decreases, the operation is the reverse of that just described.

This device was patented through the Scientific American Patent Agency, February 6, 1877, by Mr. E. O. Martin, of Greece City, Pa.

Plowing with Dynamite.

We have already mentioned that dynamite has been used for plowing; and agriculture will derive advantage from this and other compounds heretofore employed in engineering. At the works for the Exposition buildings, now going on at the Trocadéro, Paris, passers-by may, at certain hours, be startled by a deep rumbling sound. This is caused by springing of dynamite mines, which, without any violent projection of materials, makes the obstacles crumble away, and breaks up the underground rocks, the fragments of which are used for the buildings. Now, dynamite will perform a similar service in the fields. The Duke of Sutherland, in Scotland, and Dr. Hamm, in Austria, have employed it for clearing land and for digging much deeper than any instrument could. A certain number of dynamite cartridges are buried at regular distances in the soil, and connected together by electric wires. The explosion is simultaneous; and, though nothing is thrown up, the field is effectually plowed.

Hide-Bound Trees.

Trees that have long stems, exposed to hot suns or drying winds, become hide-bound. That is, the old bark becomes indurated—cannot expand—and the tree suffers much in consequence. Such an evil is usually indicated by gray lichens, which feed on the decaying bark. In these cases, says the *Gardener's Monthly*, a washing of weak lye or of lime water is very useful; indeed, where the bark is healthy, it is beneficial thus to wash trees, as many eggs of insects

are thereby destroyed. We would, however, again refer to linseed oil as a wash, as far more effective for insects, and it would, perhaps, do as well for moss and lichens. After all, these seldom come when trees are well cultivated. It is neglect that makes poor growth, and it is poor growth that makes lichens.

Great Eruptions.

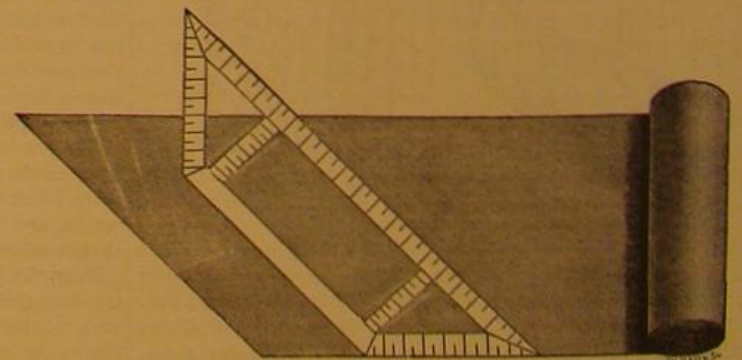
Two tremendous volcanic eruptions have lately occurred in the Hawaiian islands, which contain the most remarkable group of volcanoes in the world. Mauna Loa, which is 14,000 feet high, has great eruptions once in seven years, which are very energetic during the brief period over which they continue. On February 14, this volcano burst forth. During the preceding afternoon, a heavy cloud of black smoke had enveloped the top of the mountain, and in the forenoon of the day above mentioned five distinct columns of fire could be seen. The smoke masses, one observer says, were ejected to a height of not less than 16,000 feet, rising with such velocity that an elevation of 5,000 feet was reached within a minute. The sky was darkened over an area of 100 square miles, and at night the illumination was so brilliant that all parts of the island were lighted up. This tremendous eruption lasted but a short time, having spent its force in about six hours.

On February 24, a submarine volcano appeared near the harbor of Honolulu. Columns of smoke arose from the surface of the sea, and large masses of lava were ejected. This volcano seemed to be upheaved by a submarine rupture, running in a straight line for nearly a mile. Several very severe earthquake shocks were felt along the neighboring land.

IMPROVED YARD STICK AND BIAS MEASURE.

The annexed engraving represents a novel and very handy implement, either for the drygoods salesman or the dressmaker. It enables the latter to solve graphically—as the mathematicians say—a geometrical problem which often vexes the feminine mind, and allows of stuff being cut to the best advantage—an important item in these days when the average female robe is a structure rivaling a suspension bridge in intricacy and requiring engineering ability of a high order to construct. Besides, the invention is calculated to secure considerable saving for the retail drygoods dealer, as the inaccurate measuring of expensive fabrics may in time aggregate a waste which figures prominently on the wrong side of the profit and loss account.

The object of the device is to insure the marking of a true bias or angle of 45° to the selvage. A yard stick is suitably divided and has two arms attached to it at exactly the angle above mentioned. There are crossbars showing the width of a bias strip. The inner bar serves to give strength, and to enable a double bias to be marked. For example, to cut off a band 3½ inches wide, a common width for trimmings, etc., the inner bar is adjusted parallel to the end of the cloth, as shown in the engraving. A line is then ruled by the yard stick and the measure is moved a corresponding distance, as indicated by the crossbars. These lines are ruled both by the yard stick and the inner bar. In this way, three strips are marked with one movement of the measure.



SOMES' YARD STICK AND BIAS MEASURE.

It is then certain that the stuff will be accurately cut, while the whole operation is done very quickly. The yard stick and arms are marked on both sides, so that the measure can be used on either side of the cloth.

The invention was patented October 10, 1876, by Mr. John K. Somes, a silk salesman of long experience. For further particulars regarding agencies, rights, etc., address J. K. Somes & Co., Springfield, Mass.

THE Missouri Senate has passed a bill offering \$10,000 reward for the discovery of a sure cure for hog cholera. Such a handsome prize should certainly stimulate the faculties of scientific men, especially those who are practical farmers.

PROFESSOR GRAY'S TELEPHONE.

We noticed last week the exhibition of Professor Gray's telephone in this city, the instrument being operated in Philadelphia. In the annexed engravings, reproduced from the New York *Daily Graphic*, the apparatus is very fully represented.

Although the operation of the instrument is intricate, the description is not difficult, because all the effects that are produced by the magnetization and demagnetization of iron, by means of electric currents passing through coils of wire, may be briefly referred to without the necessity of going into an explanation of how the wires are placed, or as to the arrangement and effect of the main and local batteries. By referring to the picture of the apparatus used by the performer in Philadelphia, the reader will observe, beneath the keyboard of two octaves, a series of small pieces of apparatus placed on shelves. These are all alike, with an exception that will be noted hereafter. An enlarged view of one of them is shown, representing a tongue of metal, A, vibrating between coils of wire, B. This tongue of metal vibrates automatically. When it is attached to the right, for example, its own movement is made to affect the electric current in such a manner that the bar of soft iron within the coil loses its power, and at the same time the bar on the left is invested

with attractive power. To accomplish this was a simple problem in electro-magnetism and requires no description here. The tongue of metal, which corresponds to a tuning fork, is thus set to moving rapidly backwards and forwards, but the number of times per second depends entirely upon its own length. No matter how violently or how softly a tuning fork may be struck, the number of vibrations is always the same per second for the same fork. The pieces of apparatus beneath the keyboard are all provided with vibrating tongues of metal of different lengths—that is of such

length as will give all the notes of two octaves. As often as any particular key is pressed down; and as long as it is kept down, the electric currents operate to make the corresponding metallic tongue vibrate. These vibrations constitute the music that the performer hears, but they are by no means the music that is heard at the other end of the line. As the tremulous tongues fly back and forth with a rapidity that defies vision, they open and close the circuit of the main wire. This, then, is all that is done so far. Each vibration is reproduced at a distance in successive waves of electricity.

Independently of those of all other notes. Following, then, these multifarious but separately cared-for elements of "Home, Sweet Home" to New York, we have to discover how they are received, sorted, and translated into air vibrations that may strike the tympanum of the ear. The wavelets are passed through sixteen pieces of apparatus, each consisting of an ordinary electro-magnet, C, having, instead of an armature, a steel ribbon, D, stretched in a metallic frame. This ribbon is tuned to vibrate at a particular pitch. Now, it is a fact, that when a piece of iron is magnetized it is increased in size very slightly, and when it is demagnetized it is restored to its original dimensions. This change is accompanied by a slight sound, supposed to be due to the arrangement and re-arrangement of molecular particles.

The wavelets of electricity produced in Philadelphia by vibrations of the metallic tongue, tuned to the note, D, for example, will pass through all the apparatus in New York, whose ribbon is tuned to C, without effect; but as soon as it comes to the D apparatus the ribbon begins to vibrate, producing the note of D. In this way the New York apparatus sorts out the wavelets of electricity and transmutates them into music. These sixteen pieces of apparatus in New York are each inclosed in an oblong sounding box, to increase the sound of the vibrating ribbons. A picture of

these boxes, arranged in symmetrical order, is also presented herewith.

EXPORTS OF ICE.—The fine new ship C. C. Chapman, built at Bath, Me., recently cleared from Boston. Her cargo consisted of 2,200 tons of ice for Calcutta and 350 bales of drills for Madras. The bark R. R. Allen, which cleared from Boston in the same week as the C. C. Chapman, took 600 tons of ice for Havana. The same company have two other vessels loading with ice for export.

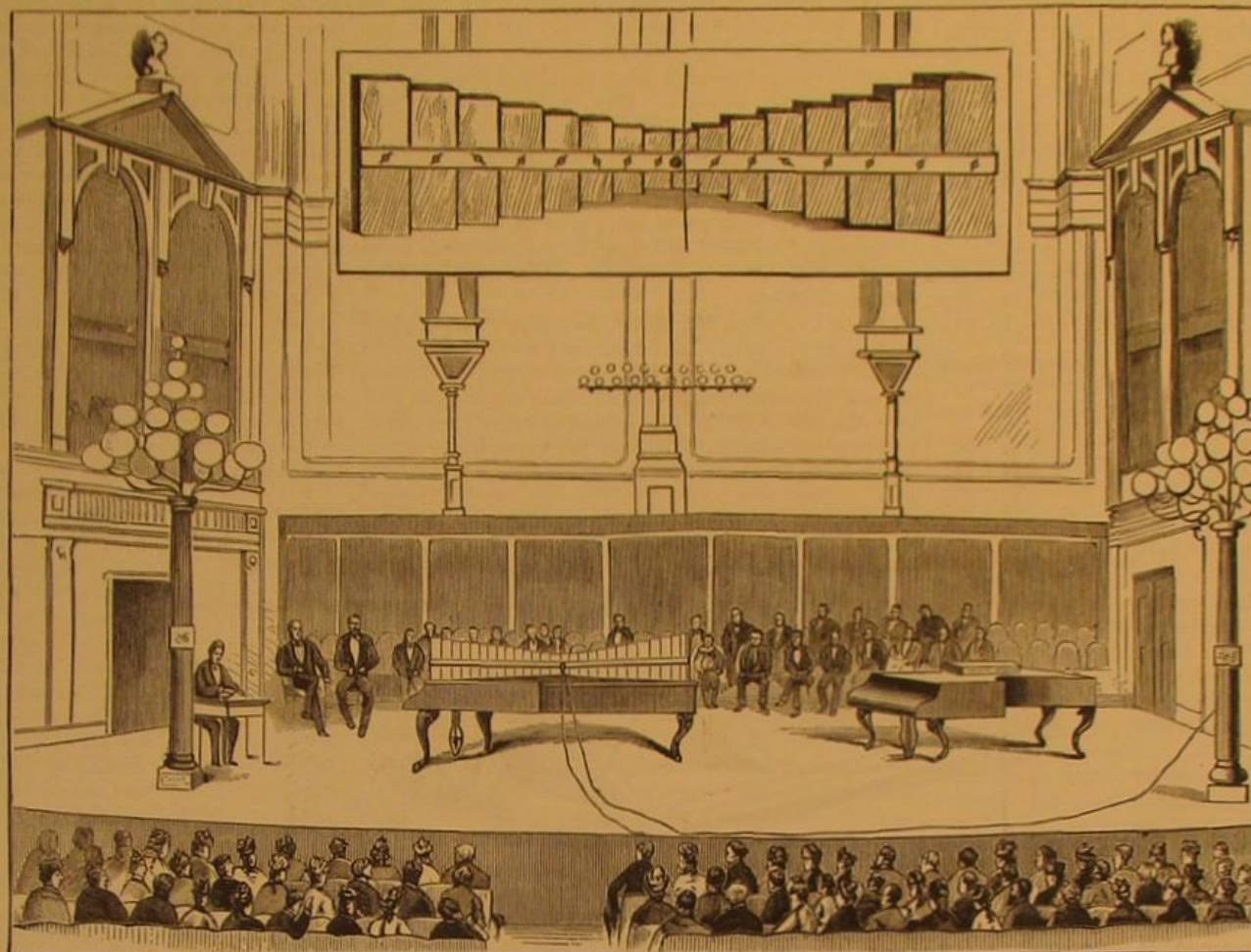


Fig. 1.—PROFESSOR GRAY'S TELEPHONE IN NEW YORK.

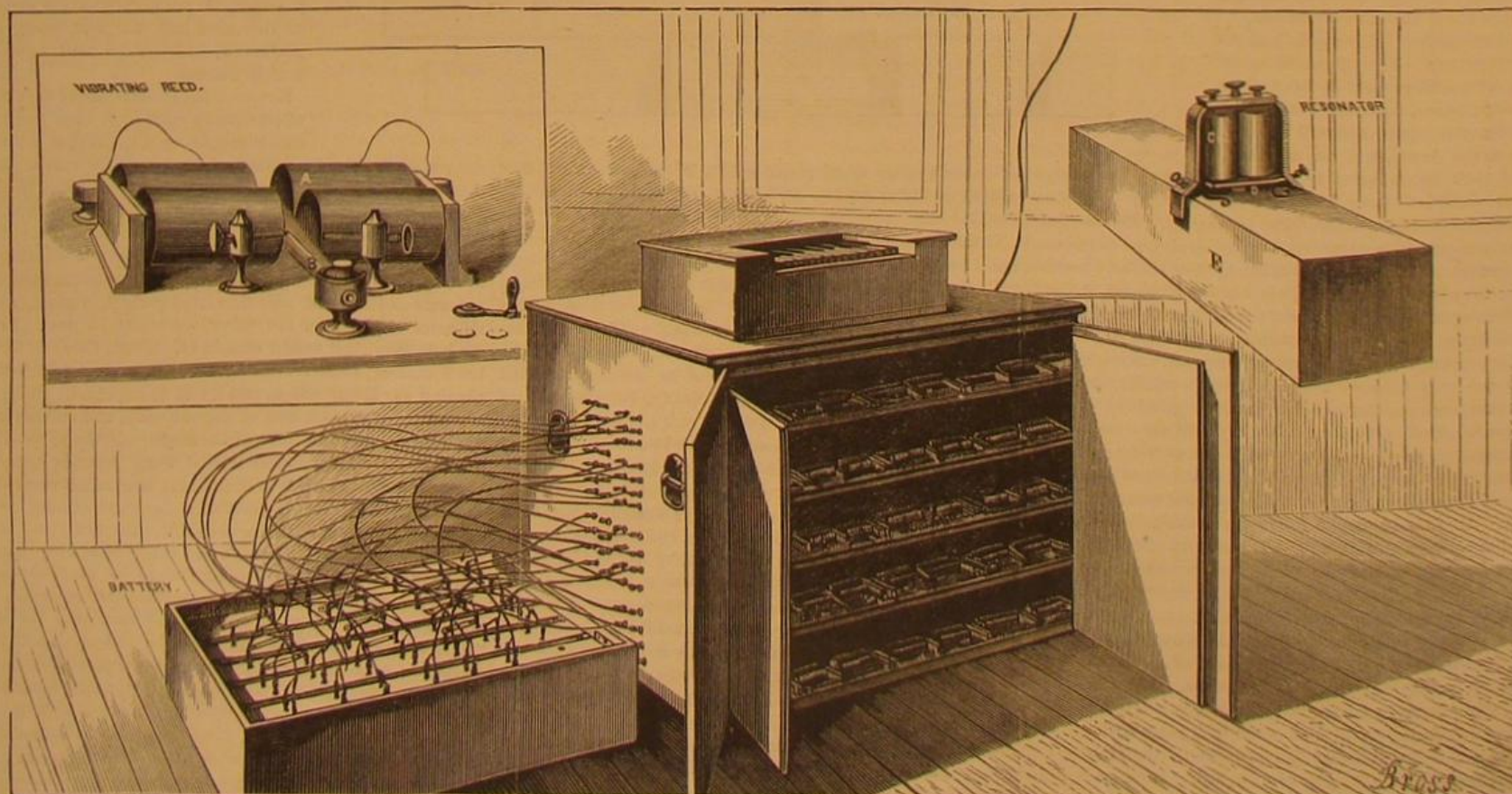


Fig. 2.—PROFESSOR GRAY'S TELEPHONE IN PHILADELPHIA.

(For the Scientific American.)

THE FRICTION OF PLAIN SLIDE VALVES.

Mr. John Hill's method of calculating the power necessary to operate a slide valve, as published in the *SCIENTIFIC AMERICAN SUPPLEMENT* of March 10, would be intelligible providing he will tell us his reason for assuming the co-efficient of friction of a slide valve to its seat to be 0.75, and also for assuming that it is possible, or practicable, to make all valves of an equally good fit to their seats, and to prevent that fit from varying, by reason of the expansion and contraction due to variations of temperature, and by further reason of the spring of the valve from the pressure upon it.

Mr. Bourne, in his "Handbook of the Steam Engine," says: "Clean and smooth iron drawn over clean and smooth iron, without the interposition of a film of oil or other lubricating material, requires about one tenth of the force to move it that is employed to force the surfaces together. In other words, a piece of iron 10 lbs. in weight would require a weight of 1 lb. acting on a string passing over a pulley to draw the 10 lb. weight along an iron table. But if the surfaces are amply lubricated, the friction will only be from $\frac{1}{10}$ to $\frac{1}{20}$ of the weight." The experiments of General Morin on the friction of various bodies without an interposed film of lubricating liquid, but with the surfaces wiped clean by a greasy cloth, have been summarized by Professor Rankine in the following table:

	Angle of repose.	Friction in terms of the weight.
Metals on metals, dry	$8\frac{1}{2}^{\circ}$ to $11\frac{1}{2}^{\circ}$	0.15 to 0.2
Metals on metals, wet	$16\frac{1}{2}^{\circ}$	0.3
Smooth surfaces, greased	4° to $4\frac{1}{2}^{\circ}$	0.07 to 0.08
Smooth surfaces, best results. $1\frac{1}{2}^{\circ}$ to 3°		0.03 to 0.036

In a paper, of which an abstract has appeared in the *Comptes Rendus* of the French Academy of Sciences, for April 26, 1858, M. H. Bochet describes a series of experiments which have led him to the conclusion that the friction between a pair of surfaces of iron is not, as it has hitherto been believed, absolutely independent of the velocity of sliding, but that it diminishes slowly as that velocity increases.

If we class the conditions under which a slide valve operates under the head of "metals on metals, dry," we are confronted at once with the question: For what reason shall we select the co-efficient as 0.15 in preference to the 0.2, or *vice versa*? If we class those conditions under any other of the headings in the table, where are we to get a co-efficient of 0.15? And if, as M. H. Bochet concludes, the co-efficient varies with the velocity of sliding, how can we assume a fixed co-efficient for a slide valve when its velocity of sliding varies with every variation in the speed of the engine, as well as at every inch of its movement? In the case of slide valves, however, the weight upon the valve is not a dead weight, but live steam; and hence, before we can make a calculation to determine the friction, we have to determine the pressure of the valve to its seat, and this, as may very easily be demonstrated, depends upon the fit of the valve to its seat.

In Appleton's "Cyclopedia" occurs the following: "Two glass or metal plates with well ground surfaces, when pressed together, will adhere with such force that the upper one will not only support the lower, but an additional weight will be required to separate them. The amount of this adhesive force has been measured by recording the weights necessary for their separation. The records of the old experimenters on this subject are worthless, because they placed a lubricating fluid (oil or fat) between the plates; they found thus the cohesion of the oil or fat, and not the adhesion of the plates. In later times, Precht, in Germany, has made the most careful experiments in this line; he took polished metal plates of $1\frac{1}{4}$ inches diameter, suspended the upper one to a balance, brought it to an equilibrium in a horizontal position, and attached the lower plate to a support beneath it. Both plates were then brought into contact, so that the flat polished surfaces covered one another perfectly, and the weights required in the scale, at the other end of the balance beam, to separate the plates were the measures of adhesion. He found thus the following remarkable law: The adhesion between two plates of the same material is the same as that between one of the plates and any material which possesses a less adhesive force. Precht found also that an attraction of the plates manifested itself at an appreciable distance before actual contact, and he even measured the amount of this attraction at the distance of $\frac{1}{4}$ of an inch by means of weights in fractions of grains. The suspended plate, when brought within this distance, was attracted with an accelerated motion till the contact took place with a slight concussion. The idea that the pressure of the air was the chief cause of the adhesion of two such plates, as it is in the case of the well known experiment with the Madgeburg hemispheres, was set at rest by Boyle, who suspended the adhesive plates charged with weight in the vacuum of an

air pump; the plates were not separated, while the hemispheres, held together by the vacuum alone, fell apart."

Now whether Mr. Hill, in assuming the co-efficient of friction for slide valves to be 0.15, has assumed the valve to fit so closely to its seat as to induce the adhesion here referred to, I know not; but it is self-evident from the foregoing that, if the valves do not fit sufficiently closely to induce adhesion, the co-efficient will be less than if, from closeness of fit, such adhesion was induced. And furthermore, a self-feeding oil cup affixed to the steam chest or steam pipe will, according to Rankine, vary the co-efficient of friction according to the amount of lubricant it supplied to the valve; for all the above authorities vary the co-efficient with the conditions, as existent in a slide valve, cannot be known, and certainly are never constant. First, then, beginning with scraped surfaces, is it not a fact that only a part of such surfaces are in contact, and what are we to presume fills or occupies the hollows of the scraping marks? According to Mr. Hill, they are under a vacuum; for he assumes the pressure on the back of the valve to be the area multiplied by the steam pressure. But what, in the conditions under which a slide valve operates, is to exclude the steam from filling the hollows?

In your own office, Mr. Editor, are a pair of surface plates used to surface valves and valve seats with. They are of cast iron, smoothly surfaced to a good fit; and beside them lies another similar plate, surfaced about as true as an ordinary slide valve. When newly fitted, either of these plates, weighing about 22 lbs., will, from the vacuum between the two surfaces, lift a plate of its own size and weight. The sizes

Fig. 1.

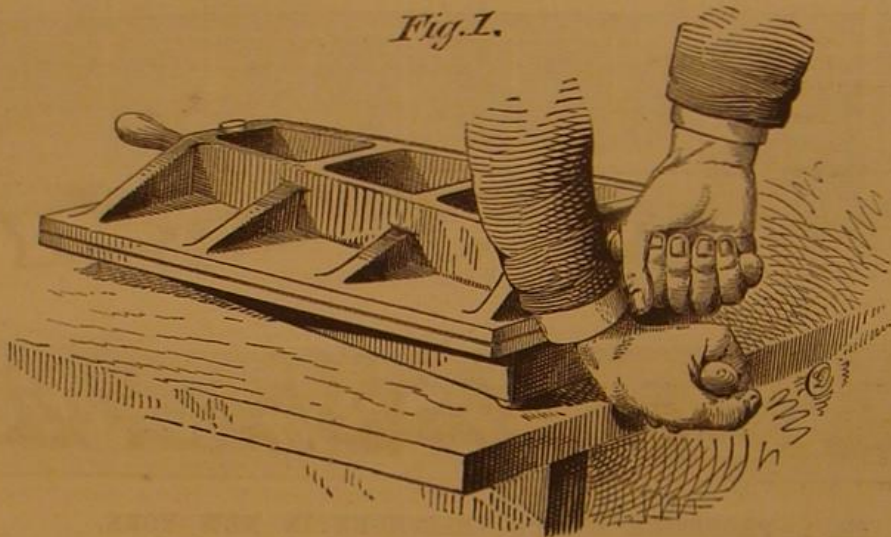
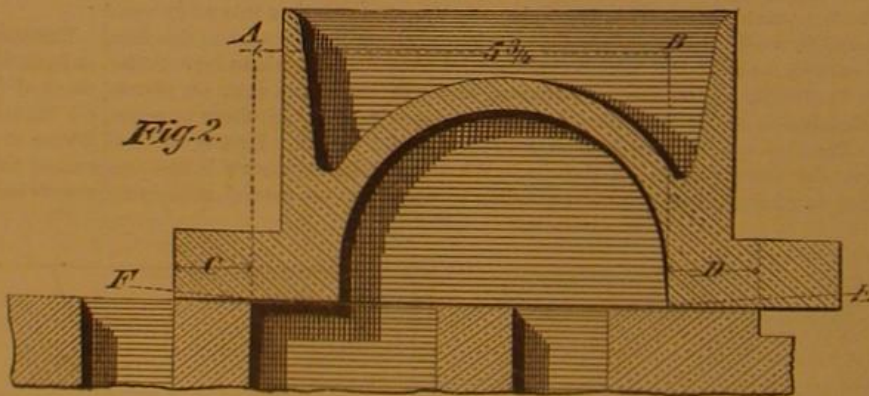


Fig. 2.



of the two finely fitted plates is 12 x 18 respectively. Their weight is about 20 lbs. each, their shapes being shown in Fig. 1.

If these two plates are carefully cleaned, and one is lowered upon the other, it does not take an ounce to slide one upon the other; indeed, unless the lower one is made to stand level, the top one will glide off. At the same time, it will lift the lower plate and suspend it (from a partial vacuum) for an indefinite length of time. It can scarcely then be said that such a surface would not be steamtight when under a steam pressure. Now accepting, for the sake of illustration, a co-efficient of friction of 0.15, and the weight of the plate as 20 lbs., it should take 3 lbs. to slide the top plate, even allowing that it was entirely free from any atmospheric pressure. What it actually does take I have never determined; but I should judge certainly not more than three ounces, and I doubt if it takes an ounce. If, however, one drop of oil is distributed by the hand over the two surfaces (having 96 inches of area each), it requires from 50 to 100 lbs. to slide the top one, according to the cleanliness from the particles of dust which fill the atmosphere (and these fall upon the surfaces even when the utmost care is taken and the greatest practicable despatch is employed in putting them together) which the surfaces may have, and on how much the plates are rubbed together.

An experiment, however, which is much more to the point, is as follows: If the surfaces of these plates are wiped as clean as it is practicable to get them by rubbing them well with dry and clean old rags, and if then we place them in contact at one corner only, and slide the top one over the

other, it has taken 341 lbs. to slide one over the other (allowance being made for the weight of the top plate), as a certificate given by the Fairbanks Scale Company at the Centennial (which certificate now lays beside the plates) attests. From this we may proceed to test Mr. Hill's co-efficient of friction. According to his theory, every 15 lbs. required to slide the plate will represent 100 lbs. pressing them together; then the 341 lbs. it takes to slide the top one divided by 15 will represent the number of hundred pounds with which the plates are pressed together: hence $341 \div 15 = 22.76 \times 100 = 2,276$ lbs. Now let us suppose that these plates have a perfect vacuum, of say 15 lbs. per inch, between them, and hence have the full atmospheric pressure of say 15 lbs. per inch upon them. Then the area of the plate (96 inches) multiplied by the atmospheric pressure (15) equals 1,440 lbs., and the difference between 1,440 and 2,276 is the actual equivalent of friction, and that assumed by Mr. Hill. It may be said that there is about 1,440 lbs. of atmospheric pressure upon the plates, and that the other 836 lbs. necessary to make up the 2,276 lbs. (that a co-efficient of 0.15 assumes there to be upon the plates, holding them together) is to be found in the adhesion above referred to. But the equivalent of friction of 0.15 is given by Rankine as in terms of the weight, and not in terms of the combined weight and whatever adhesion the smoothness of the surfaces may induce. Nor is it possible to give a definite co-efficient of friction, if the friction due to the weight or pressure is to be supplemented by an amount of adhesion induced by and varying with the smoothness and perfection of the fit. If we disregard the element of adhesion, and use, as Mr. Rankine does, a co-efficient in terms of the weight (*vide* Bourne);

and if we then allow that co-efficient to be 0.237 instead of Mr. Hill's 0.15 (and 0.237 will be about the co-efficient allowed by General Morin, the excess of the last two figures being accounted for in the fact that 0.2 is for an angle of repose, whereas my plates lay level), then we have as follows: Every 23.7 it requires to slide these plates represents 100 lbs. pressing them together; hence the 341.5 lbs. required to slide the plate, divided by 23.7, equals 1,440 (nearly), and this equals the allowed atmospheric pressure of 1,440 lbs. resting upon the plates. It is not to be presumed, however, that these plates are in perfect contact, and hence there is presumably air, to some extent, between them; and it is only reasonable to assume that, if they had, instead of about 15 lbs. per inch upon them, the 130 lbs. per inch under which many slide valves operate, they would be in more perfect contact, and would require more power to slide them. In other words, the co-efficient of friction would be increased in proportion as the air was more perfectly excluded from between the surfaces: providing, however, that there were no elements tending to warp the plates out of truth, and therefore to impair the contact of the surfaces and thus admit the pressing element, be it air or steam, between them. In a slide valve, however, there are several elements which preclude the possibility of the surfaces of the valve and the seat being of a perfect fit, and these I will now separately discuss.

Suppose that all slide valves were made of an equally good fit to their seats (and this is supposing a good deal when we

remember that some engine builders put in the valves just as they were planed, making no attempt to fit them to their seats on the cylinder port faces, while others file them to a fit, and others again scrape both valve and seat true to a surface plate). Suppose that the co-efficient of friction, whether due to the pressure only of the valve to its seat or to the combined pressure and induced adhesion from perfect contact, was in all cases alike, when the valves were put in new. Let us see how long they would remain so. First, then, an iron or brass casting, heated after having the surface removed by planing or filing, warps, and its fit is impaired. With the loss of the fit goes a loss of the adhesion, and an admission of steam beneath that part of the surface of the valve which does not fit. How much it will warp depends upon the temperature to which it is heated, on how much was cut off the planed face, on how unevenly the valve casting cooled after being taken out of the mould, on the shape and thickness of the valve, and on several other elements. Let us presume, however, that a casting could be made so that it would not warp from having its surface skin removed, and that, by heating the valve after it had been once surfaced, the reset had taken place, and the valve, being refaced true, would not again warp from being reheated (as experience demonstrates that it always does), and that, being heated to a given temperature, it would remain as close a fit to its seat as it was when cold. Then, just so soon as the temperature varied, the expansion and shape of the valve would vary. Cast iron expands by heat, in proportion to the temperature. The valve has, acting on the inside area of its exhaust port, the cooling effects of the atmosphere, which finds ingress

through the exhaust pipe. The exhaust steam itself lowers in temperature as its pressure decreases, and the live steam on the back of the valve is comparatively constant in temperature: as a result, then, the valve is continually changing in form from the expansion due to the high temperature of the exhaust steam during the early part, and the lower temperature during the latter part, of the exhaust. Now comes another and more important question, and that is: How far will the spring of the valve, from the pressure of the steam upon its back, affect the fit to its seat, and will it so spring as to permit of a fine film of steam finding its way beneath the wings of the valve, thus relieving, to a certain extent, the amount of its pressure to its seat?

If we take a pair of the plates shown in Fig. 1, and get them so closely together that it requires, say, 340 lbs., to slide one upon the other, and then take hold of the plates by the handles, as shown in our engraving, we can pull them apart by exerting a force of about 130 lbs.; in other words, it will require but little more than one third as much power to pull them apart, in this manner, as it requires to slide one upon the other. In thus pulling them apart, we have, upon the back, whatever weight of the atmosphere the fineness of the fit leaves unbalanced, and, in addition, whatever amount of adhesion the perfect contact of the surfaces may induce. Hence, allowing a co-efficient of friction of 0.15, we should have 2,276 lbs. holding the plates together; and while allowing a co-efficient of 23.7, we should have 1,440 lbs. resisting the effort to pull the plates apart. The fact, therefore, that 130 lbs. will actually, under the conditions shown, pull the plates apart, appears at first sight not a little singular. The solution, however, is simple enough. The plates spring from the pressure placed by the hands upon them, and hence they unlap and come apart just as if we took two sheets of paper, placed together and soaked with water, and then took hold of two corresponding corners and pulled them apart. The plates are $\frac{1}{2}$ inch thick in the body, and the ribs are each $\frac{1}{4}$ inch thick and $2\frac{1}{2}$ inches high; and yet 130 lbs. applied as shown will spring them sufficiently to let the air get in between them. Let us in the light of this fact examine the shape and pressure upon a slide valve (assuming for the nonce that the pressure is the unbalanced area in contact multiplied by the steam pressure), and ascertain whether it is reasonable to suppose that the pressure of the steam upon the valve springs the wings, and permits the steam to find its way beneath them.

In Fig. 2 is shown an ordinary locomotive slide valve, the ports being $1\frac{1}{2} \times 17$ inches, the bridges between ports 1 inch wide, the cylinder exhaust port $2\frac{1}{2}$ inches wide, and the valve having 1 inch of steam lap, covering the ends of the cylinder ports 1 inch at each end. When the valve is in the position shown, it will be noted that there is a very large proportion of the area of the valve unsupported by the seat; the area of this portion will be in this case $5\frac{1}{2}$ inches, as marked in the engraving, one way, and 17 inches the other = 97.75 inches. Now supposing the steam pressure to be 130 lbs. per inch: then $97.75 \times 130 = 12,707$ lbs., the assumed pressure of the valve to its seat, tending to spring the flanges or wings in the direction denoted by the dotted lines, E and F, respectively. What have we to offset this amount? The area of one bridge equals 17, the area covered under the valve flange at D equals 11 inches, and the amount of the valve flange overlapping the ends of the steam ports equals 15.5; total 43.5 square inches, which, multiplied by the steam pressure, would give 5,655 lbs. as the pressure tending to spring the valve wings in the direction marked. There will, it is true, be a pressure placed on the underneath side of the valve by the exhausting steam, the area thus acted on being, in the position shown, 97.79 square inches; but it can scarcely be advanced that this pressure can be sufficient to relieve the valve from its liability to spring from the 5,655 lbs. on the other side.

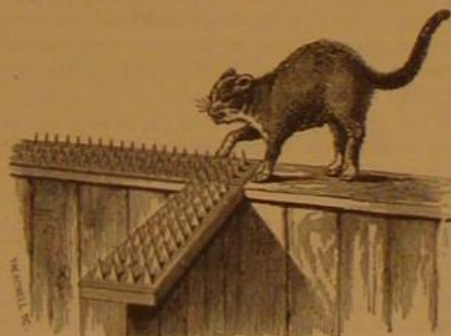
Theoretically, a valve will spring of its own weight; and that it will spring from the pressure which a man can put upon it with his hands, I have often found in facing valves up. For example, if, in trying the valve on the surface plate, the former is pressed in the middle by the hands to make the plate mark the face plainly, and the valve is fitted under these conditions to a practically perfect fit, the surface plate marks showing equally all over, we may then let the valve lie upon the plate of its own weight only, and the marks will show (after of course moving the valve back and forth) at and near the edges of the valve only, showing that the pressure of the hands sprung it. There are plenty of instances of metal in the most solid of forms springing of its own weight: witness the Morton Poole rolls, which, though of chilled cast iron and 12 inches in diameter, spring and bend by the insertion between them of a piece of gold leaf $\frac{1}{16}$ inch thick. There is yet another part of this question, however, which is found in practice to be of the utmost importance, and that is (as a visit to any locomotive repair shop will demonstrate, by the engines that come in to be repaired), that the valve wears out of truth, and so does the seat. In my experience, I have chipped a full $\frac{1}{16}$ inch off valve seat faces without cutting the worn grooves out. I have examined, or had come under my observation, at least 400 slide valves, and I never saw one that was, after working three months, of a sufficient fit to its seat to require 1 lb. more than its own weight to lift it from its seat; whereas, if such a valve as is shown in Fig. 2 were of a practically perfect fit, it would require, when in mid-position, some 800 lbs. to lift it vertically, taking hold of the ribs outside the arch. The fact is that the bridges wear hollow lengthways, and hollow, as denoted by a straight edge, over the seat and

across the bridges. Then there usually wears in the seat face a groove at right angles to, and close to, the edges of the ports. To remedy this, a practice sprung up in England, in about the year 1865, of drilling, in the face of the valve and in a line with the exhaust port edge, a hole in each wing; and this hole may be found mentioned in recent engine specifications published in this city. Now just so soon as a valve face loses its smoothness, though the grooves may be only the one hundredth of an inch deep, or like coarse file marks, it becomes impracticable to exclude the surrounding air at atmospheric pressure, let alone steam at a high pressure, from between the surfaces.

I have a plate of the same size as those shown in Fig. 1, which has been planed and not fitted in any way. The planer marks are all intact. By placing a finished true plate upon it, the partial vacuum between the two will lift the planed one; but in about ten seconds it will fall, because the weight of the plate causes it to sag, and the air travels along the fine planer marks until there is not sufficient vacuum to sustain the weight of the plate, which is about 20 lbs. Now since the planed plate can be lifted by the vacuum, it is at least as good a fit as an ordinary slide valve, and under a steam pressure would undoubtedly be steam-tight, although the steam, like the air, would find its way along the planer marks, and thus counterbalance a large proportion of the pressure placed by the steam on the back of the valve. How much the elements of warping from expansion, changing form from irregular temperature, and counterbalancing from steam finding its way beneath the valve, will affect the pressure of a valve to its seat whether these causes act either in concert or partly counteract each the other, will depend upon the shape, size, strength, etc., of the valve. Isaac Walton said, in giving instructions how to cook a trout, "first catch your trout;" so it may be justly said, in calculating the friction of a slide valve, first find your pressure. New York city. JOSHUA ROSE.

THE CAT TEASER.

No one who in the chill midnight air has hurled improper language and miscellaneous toilet articles at feline vocalists chanting on the back fence can afford to remain in ignorance of the merits of the ingenious little device represented in our engraving. It prevents cat concerts, simply by preventing the cats from prowling on the top of fences; and it compels them to take refuge on the fences of one's neighbors. Distance then lends enchantment to their howls, and the thoughtful man who has provided himself with the cat teaser "may wrap the drapery of his couch about him and lie down to pleasant dreams," lulled by the distant wails, mingled with the profanity of some one several doors away, both reduced to gentle murmurs ere they reach his ear.



The cat teaser consists of a strip of sheet metal in which V-shaped cuts are made. The pointed pieces of the metal are then bent upward so as to stand perpendicularly; and the strips are tacked on the top of the fence. It is not necessary to surround an entire back fence with the device, because, if the fence at the rear end of the yard, and for a short distance adjoining on each side, is covered, cats cannot jump into the yard from the adjoining fences. It is impossible for a cat to walk on the points, nor can she insert her paws between them. Not only fences but roofs may thus be protected, while the device may also be used for keeping cats away from flower beds.

Practical tests of the invention have shown that it is discouraging to cats in a high degree. Tom cats of exceptional intelligence, who have long treated with contempt such trivial obstacles as spikes and broken glass, have retreated baffled before the teaser. As a means of preventing chickens roosting on unauthorized fences, the device has also proved very useful, and carries far deeper conviction to the mind of the average hen than does throwing stones at her after she is comfortably settled for the night.

Persons who value slumbers unbroken by feline melodies should address the inventor, Mr. C. L. Topliff, P. O. box 773, New York city.

A Silk-Spinning Fish.

There is a mollusk—the *pinna* of the Mediterranean—which has the curious power of spinning a viscid silk which is made in Sicily into a textile fabric. The operation of the mollusk is rather like the work of a wire-drawer, the substance being first cast in a mould formed by a sort of slit in the tongue, and then drawn out as may be required. The mechanism is exceedingly curious. A considerable number of the bivalves possess what is called a *bysus*, that is, a bundle of more or less delicate filaments, issuing from the base of the foot, and by means of which the animal fixes itself to foreign bodies. It employs the foot to guide the filaments

to the proper place and to glue them there; and it can reproduce them when cut away. The extremity of the thread is attached by means of its adhesive quality to some stone; and this done, the *pinna*, receding, draws out the thread through the perforation of the extensible member. The material when gathered is washed in soap and water, dried, straightened, and carded—1 lb. of coarse filament yielding about 3 ozs. of fine thread, which, when made into a web, is of burnished golden brown color. A large manufactory for this material exists in Palermo.

Ross Winans.

Mr. Ross Winans, one of the many inventors who have amassed colossal fortunes, recently died in Baltimore, Md., at the age of 81 years. Mr. Winans began life as a merchant's clerk, but laid the foundation of his fortune by rearing horses. His first invention was a plow, that had a large sale. In 1830, he became interested in the building of rolling stock for the Baltimore and Ohio Railroad Company; and for the succeeding thirty years of his life he devoted himself to the designing of railroad cars and locomotives. The heavy freight engine known as the camel-back is his invention; and he also claimed to have originated the modern eight-wheeled passenger car. His shop became famous, and he built a large number of locomotives, and in this way accumulated the greater part of his wealth. During the war, he devised a steam gun for the Southern army, but it was captured by the Federal forces almost immediately, and thus never used. It was not a formidable weapon. Since his withdrawal from locomotive building, Mr. Winans has tested plans for improved working men's dwellings with much success. Thirty years ago he was offered the management of the Russian railways by the Czar, but this he declined in favor of his sons, who brought much ability to the work. Recently, Mr. Winans has resided on his model farm near Baltimore.

Blocking the Straits of Belle Isle.

In this city a kind of mild war is chronic between the Harbor Commissioners on one hand and the police authorities on the other, the subject being the disposition of ashes and solid refuse of all kinds, not susceptible of utilization, which if thrown into the bay tends to fill up channels and otherwise to obstruct navigation. At present, this material is carried out to sea in large scows, and there dumped. A new engineering scheme, rather startling in its magnitude, has recently been advocated, which, as a daily contemporary suggests, if ever seriously regarded, will afford an outlet for all the ashes, etc., New York and all other Atlantic coast cities can furnish. The project is to block up the Straits of Belle Isle, the object being to divert the ice which comes down every year from Baffin's Bay, through the Straits, and which makes the shores past which the icebergs float many degrees colder than those to the eastward, which face the ocean and get the benefit of the Gulf Stream. It is believed that, if this project could be accomplished, the climate of Anticosti and of the Gulf of St. Lawrence would be greatly modified, and navigation through the neighboring waters could be kept open during the whole year. In the narrowest portion, the width of the Straits is $8\frac{1}{2}$ miles.

Whole Ox Soup.

In Australia, where the horned stock has increased of late in a more rapid ratio than the population, the supply of meat is much greater than the demand; and at the present time the price of cattle is commonly quoted "at boiling rate;" that is, the animals will fetch no more from the butchers than can be realized for their hides, horns, hoofs, tallow, etc., for exportation. In large establishments devoted to preparing these utilizable portions of the bullock, there was of course an immense waste when the ox went into the melting pot; but this loss is now in a great measure avoided by boiling the animal at once into soup, or concentrated extract of beef. After the head, horns, hoofs, etc., are removed, the meat is cut into convenient sized pieces and conveyed to immense steam-tight double cylinders capable of holding upwards of fifty bullocks at a time. In seven hours, during which they are subjected to a pressure of steam of 15 lbs. per square inch, the bones and meat are reduced to a pulp. The steam is then condensed, and the tallow, which floats on the surface, drawn off. The pulp is removed and placed in a powerful press, which squeezes out the soup. The latter is, however, not yet sufficiently concentrated; and to render it so, it is placed in a peculiarly constructed boiler, there reduced by evaporation, and finally run off into bladders. When cold, the essence is semi-transparent, of a rich reddish brown color, and sweet to the smell and taste, almost like confectionery. A whole bullock, after being thus treated, yields but 20 lbs. of soup.

Telephonic Music.

At a recent telephonic concert in Washington, it was stated by the lecturer that the electric waves of sound sent through a single wire are frequently conveyed, indirectly, by other wires running parallel with it on the same poles, although entirely disconnected from it. This statement was verified in the Washington office of the Associated Press, where a number of the tunes played in Philadelphia, and conveyed electrically to Lincoln Hall in Washington, were distinctly heard on the relay used in the Press office, which had no connection with the wire that was attached to the telephone. The tones thus conveyed, although not loud, were stated to be audible at a distance of several yards from the instrument.

Cancelling Postage Stamps.

Every year, in something over 30,000 offices, the Post Office department cancels a thousand million postal stamps of one sort and another. It was really a little more than this last year—1,049,767,507—but a few thousand more or less make small difference. The thousand million give work enough. One third, the stamped envelopes and the postal cards, cancel themselves, in a sense. No one can use them twice. The stamps nobody has yet been able to cancel fairly and completely, and within the past month the department closed two years of experiment no wiser than it began.

A new ink is generally the stronghold of cancelling genius, and to the fat inks—printers' and metallic inks—writing fluid, the three principal acids, caustic potash, and a drug shop of other chemicals have been added by genius at work on a letter stamp. There is a sulphuric acid ink there which came from Cincinnati, warranted to cancel a stamp, and which eats a hole through the envelope into the bargain. There is one of caustic potash, backed by a distinguished chemist, which blisters a man's fingers at touch, and has its effects on the glass bottle which holds it. Nitric acid is at the bottom of another ink, and fills the air as it is used with the fumes familiar to laboratories. All these inks do too much. Most of them too little. Your average inventor never tests his invention.

There are other ways to cancel stamps, by genuine cancellers. They have all been invented—a good many separate times. There is one ingenious contrivance which brings a disk down with a half turn at the stamping—a slanting slot does the work—and rips half the features off G. W. or Franklin. Somewhere along the ten-thousandth letter this dulls and takes a blow like a sledge hammer to do its work. The New York Post Office cancels two million of stamps a year, and the New York clerk takes more kindly to the firm, light tap of a wooden stamp. No invention has displaced that any more than the ink.

So the department has given over the attempt to cancel. Gets three cents for a good many stamps, and carries six or nine cents mail matter under the stamp. Is it not a profitable operation? "Do they have this bother in England?" I asked. "Oh, no; they black their stamps up so thoroughly." "Why can't we?" "Well, our postmasters are not so careful, and in England they make a row with a man if a stamp is not properly canceled. We can't do that. The department doesn't have enough control, and can't get at a man so sharply." "Then this whole loss is simply a question of a civil service, efficient or not?" "Well, yes; about that."—*New York World*.

Spring Ailments.

The remedy for spring diseases, says *Hall's Journal of Health*, by whatever name, is: Eat less. We do not mean that you shall starve yourself, or that you shall deny yourself whatever you like best, for, as a general rule, what you like best is best for you; you need not abandon the use of tea or coffee, or meat, or anything else you like, but simply eat less of them. Eat all you did in winter, if you like, but take less in amount. Do not starve yourself, do not reduce the quantity of food to an amount which would scarcely keep a chicken alive, but make a beginning by not going to the table at all, unless you feel hungry; for if you once get there, you will begin to taste this and that and the other, by virtue of vinegar, or mustard, or syrup, or cake, or something nice; thus a fictitious appetite is waked up, and before you know it you have eaten a hearty meal, to your own surprise, and perhaps that, or something else, of those at table with you.

The second step towards the effectual prevention of all spring diseases, summer complaints, and the like, is: Diminish the amount of food consumed at each meal by one fourth of each article, and to be practical, it is necessary to be specific; if you have taken two cups of coffee, or tea, at a meal, take a cup and a half; if you have taken two biscuits, or slices of bread, take one and a half; if you have taken two spoonfuls of rice, or hominy, or cracked wheat, or grits, or farina, take one and a half; if you have taken a certain or uncertain quantity of meat, diminish it by a quarter, and keep on diminishing in proportion as the weather becomes warmer, until you arrive at the points of safety and health, and they are two: 1. Until you have no unpleasant feeling of any kind after your meals. 2. Until you have not eaten so much at one meal, but that, when the next comes, you shall feel decidedly hungry.

Supplies being thus effectually cut off, that is, the cause being first removed, Nature next proceeds to work off the surplus, as the engineer does unwanted steam; and as soon as this surplus is got rid of, we begin to improve; the appetite, the strength, the health return by slow and safe degrees, and we at length declare we are as well as ever.

Hurry and High Pressure.

It is the pace that kills; and of all forms of overwork, that which consists in an excessive burst of effort, straining to the strength, and worrying to the will, hurry of all kinds—for example, that so often needed to catch a train, the effort required to complete a task of head work within a period of time too short for its accomplishment by moderate energy—is injurious. Few suffer from overwork in the aggregate; it is too much work in too little time that causes the breakdown in nineteen cases out of twenty, when collapse occurs. Most sufferers bring the evil on themselves by driving off the day's work until the space allotted for its performance is past, or much reduced. Method in work is the great need

of the day. If some portion of each division of time was devoted to the apportioning of hours and energy, there would be less confusion, far less hurry, and the need of working at high pressure would be greatly reduced, if not wholly obviated. A great deal has been written and said of late, to exceedingly little practical purpose, on the subject of "overwork." We doubt whether what is included under this description might not generally be more appropriately defined as work done in a hurry, because the time legitimately appropriated to its accomplishment has been wasted or misapplied. Hurry to catch a train generally implies starting too late. High pressure is, says the *Lancet*, either the consequence of a like error at the outset of a task, or the penalty of attempting to compensate by intense effort for inadequate opportunity. If brain is bartered for business in this fashion, the goose is killed for the sake of the golden eggs, and greed works its own discomfiture.

Stream Power and its Utilization.

Almost every man has about him in his daily walk sufficient apparatus for a tolerably accurate estimate of the quantity of water flowing in any stream. A walking stick, a jack-knife, and a watch, provided the walking stick is just three feet long, are all the tools necessary for the purpose. With these simple appliances, says *The Millstone*, the power may be measured in the following manner:

Take a section of the stream as uniform in breadth and depth as possible, and measure off upon its bank some definite length, say from one to four hundred feet, according to the rapidity of the water; set a stake close to the water at each end of this section, then throw into the water, opposite the upper stake, a green twig or limb of a tree or other object of such specific gravity as to nearly but not quite sink, and of such size that one portion shall remain at the surface while another portion nearly touches bottom, the object being to get the average speed of the water. The resistance caused by the bed and banks of the stream necessitate some care in this part of the experiment.

Note accurately the time the object is passing from stake to stake, and repeat the operation several times and at as many points towards the opposite shore; the sum of the several times divided by the number of points at which the speed was taken gives the average speed of the water.

Now measure the depth at several equidistant points across the stream, *a, b, c, d, e, f*, (the diagram showing a cross sec-



tion of the stream). The sum of these depths divided by the number of points at which the depth was measured gives the average depth; this average depth multiplied by the breadth of the stream gives the area of the cross sections; this area, multiplied by the length of the section, gives the cubic contents of body of the water embraced in the section. Thus we have the quantity and its velocity, which are elements necessary to show the value of a stream for manufacturing purposes, provided it has sufficient fall anywhere to render it available.

Allowing 62 lbs. for each cubic foot of water, and a supply of 1,000 cubic feet per minute, and a fall of 10 feet, we have 1,000 multiplied by 62, equals 62,000 lbs.; 62,000 multiplied by 10 equals 620,000 lbs. momentum; 620,000 divided by 33,000 equals 18.7 horse power. One fifth at least must be deducted for friction and loss, making in this case about 15 horse power.

Velocity of Electricity.

Dr. Sabine has devised a method of measuring the contour of electric waves passing through telegraph lines. It is probable that in this sense alone electricity may be said to have a velocity. The early experiments on the time elapsing, between starting electricity into one end of a conductor and receiving it at the other end, gave totally contradictory results. This interval would depend on the electromotive force employed, the resistance and capacity of the conductor, and the sensitiveness of the receiving instrument. It would therefore by no means be proportionate to the length. By the following method the electrical condition of any point of the line may be examined quantitatively at intervals of 0.001 of a second or less after starting the electric impulse. It thus becomes possible to measure the form and speed of a wave. Suppose one end, A, of a conductor, A B, is placed to earth, and that the other, B, is connected with one pole of a battery whose second pole is put to earth. Then any point of the conductor, as C, will assume a potential which will be proportional to the resistance of A C. This potential may be measured by connecting C for an instant with a condenser or accumulator, and then discharging the latter through a delicate galvanometer. When the circuit is first closed, a minute interval of time is required before C will attain its full potential measurements made of the relation of these quantities, showing the form of the electric wave passing the point, C. The only mechanical difficulty is to construct a chronograph which will allow C to be connected with the condenser, a small but accurately determined time after A is connected with the battery. A heavy wheel of brass is set in motion by a steel spring so that it shall revolve exactly twice a second. The interval through which the spring acts being always the same, a nearly constant velocity is always imparted. The disk is divided into 500 equal parts. A movable index serves to regulate the angle through which

the disk turns between the two connections to be recorded. The time of revolution of the disk was first determined by noting the figures read in succession under the film of a small telescope, when the disk was illuminated by half-second flashes of an induction coil. The force of the spring and the position of the trigger releasing it were adjusted until the right velocity was obtained. Recently a condenser was discharged through a known resistance for some interval indicated by the disk, and the time calculated, according to the leakage formula, from the initial and final readings of the galvanometer. If the two do not agree, the spring is altered until they do; but its action is found to be very constant and not to need alteration, except after taking the apparatus to pieces for alteration. Several series of experiments are given, and the results show the delicacy and accuracy of the method. —*Philosophical Magazine*.

NEW BOOKS AND PUBLICATIONS.

ELEMENTS OF GEOMETRY. By G. M. Searle, C.S.P. Price \$1.50. New York city: John Wiley and Sons, Publishers, 15 Astor Place.

The author's principal object in the preparation of this work has been the desire to reduce what is supposed to be self-evident to the smallest possible amount, and thus to make the science more strictly logical. There are several peculiarities about the treatise, notably the avoidance of definitions until the thing to be defined has been shown to be possible, the omission of the theory of proportions and substitution of the equality of fractions therefor, besides various other minor points, which tend to render the work conformable to the author's general plan. The volume as a result is rendered much smaller than the ordinary school geometry, and therefore, while giving the student a more logical and connected view of the science, will, it is believed, enable him to master the same in shorter time.

STRENGTH AND DETERMINATION OF THE DIMENSIONS OF STRUCTURES OF IRON AND STEEL. By Dr. P. J. J. Weyrauch. Translated by A. Jay Du Bois, Ph.D. Price \$2. New York city: John Wiley and Sons, Publishers, 15 Astor Place.

"More attention to just such facts as are here set forth and worked into a general method of dimensioning—facts which have long been at disposal, but never before properly set forth in a shape to meet the daily wants of the practicing engineer and constructor—would make such sad disasters as that at Ashtabula impossible." (Translator's preface). True, so far as the facts are concerned, but not so as regards this book. When authors attain that happy facility of producing works with say seventy-five per cent less formulas and heavy mathematics, then (and not until then) will their books "meet the daily wants of the practicing engineer." If all practicing engineers were scientists of the rank of Dr. Du Bois or Dr. Weyrauch, we do not doubt but that this book would be just the thing needed. But we venture to assert that not one practicing engineer in fifty would take the time to stop in the middle of his work and pore over this volume to find out what the formulas mean and how they are to be applied. Literature for the study may be as theoretical and as abstruse as the authors choose to make it; but where it is meant for practical purposes, it cannot be too clear and simple. For an illustration of our meaning, we refer to the pages of this journal, where many a subject, which has appeared elsewhere buried in calculus and the Greek alphabet, is elucidated in plain English and by simple computation. Professor Thurston adds an appendix on his strain diagrams, all of which is old and has been repeatedly published in substance elsewhere.

Inventions Patented in England by Americans.

From March 9 to March 22, 1877, inclusive.
ANIMAL PULP.—L. Coburn, Worcester, Mass.
BOILER FURNACE, ETC.—B. Hershey, Erie, Pa.
CANCELLING STAMPS, ETC.—W. Morris, Richmond, Va.
ELECTROPLATING WIRE.—W. Wallace, Ansonia, Conn.
FISH PLATE, ETC.—J. Eno, Council Bluffs, Iowa.
GAS RETORT PROCESS.—W. Karr, Frostburgh, Md.
HORSESHOE BARS.—W. M. Greenwood & Co., Cincinnati, Ohio.
LATHES.—W. S. Cooper, Philadelphia, Pa.
LIME KILN FLUE, ETC.—W. S. Sampson, New York city.
MAKING ICE, ETC.—E. A. Gillet, New York city.
MAKING STEEL.—S. Barker, Knoxville, Tenn.
RIBBON HOLDER, ETC.—H. V. Dempster, Washington, D. C.
RULING MACHINE.—W. O. Hlekok, Harrisburgh, Pa.
SACK-SEWING MACHINE, ETC.—W. Webster, San Francisco, Cal.
SMELTING FURNACE, ETC.—G. H. Moller & Co., Plainfield, N. J.
STOP VALVE.—E. Russell, New York city.
TRAMWAY CAR.—J. Stephenson, New York city.
WASHER, GASKET, ETC.—Vulcanized Fibre Company, Wilmington, Del.

Recent American and Foreign Patents.

NEW MISCELLANEOUS INVENTIONS.

IMPROVED METHOD OF ATTACHING KNOBS TO SPINDLES.

William De Courcy May, Baltimore, Md.—The object of this invention is to provide a means for preventing the loosening and loss of the screw that fastens the knob of a door to its shaft. The improvements relate to the use of a band, ring, or sleeve, made to encompass the socket portion of the knobs so as to cover the screw, and consist, first, in constructing such band, or sleeve, with a transverse slit to permit the same to be opened and be sprung laterally upon the socket or shank of the knob; and, secondly, in constructing such band, or sleeve, with one or more tongues which enter the nick of the screw and prevent it from turning.

IMPROVED SADDLE.

Henry Ruwart, Jefferson City, Mo.—This invention embodies certain improvements in saddletrees designed to render the saddle convertible at will into either a gentleman's saddle, a lady's saddle, or a "mule" or harness saddle. The improvement consists in constructing the tree at its front end, opposite the cantle, with a key and a locking bolt, and the pommel, horns, or cap with a bottom plate provided with a slot corresponding to the key, and a perforation or recess for the locking bolt; so that when the pommel, or its equivalent, is placed upon the tree and turned around to a given position it is securely attached to the saddletree.

IMPROVED THILL COUPLING.

John L. Crist, William E. Crist, and George H. Smith, Sacramento, Cal.—This coupling, for thills or shafts of vehicles, consists of a spring for connecting each of the shafts with a clamp or clip attached to the axle, and upon the lower end of the said spring a rib is formed that engages with the clip when the end of the spring is clamped by a set screw in the clip. The spring is sufficiently rigid to support the thills, while it is also sufficiently flexible to permit of the required latitude of motion. All rattling and noise are obviated by the improvement, and the thills are readily attached and removed. To afford additional security, a ring may be added for receiving a strap that is attached to the thills.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED AUTOMATIC WAGON BRAKE.

Charles T. Warren, Atlanta, Ga.—This improved brake for vehicles is so constructed that it will be applied to the wheels by the operation of holding back, and at the same time will allow the vehicle to be backed without its being thrown into action. The construction is simple and ingenious, rendering the device excellently adapted to its purpose.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion. If the Notice exceeds four lines, One Dollar and a Half per line will be charged.

For Sale.—Face Lathes, nearly new, very strong, with or without iron crane. G. Hardie, 62 Church St., Albany, N. Y.

600 New and Second-hand Portable and Stationary Engines and Boilers, Saw Mills, Wood Working Machines, Grist Mills, Lathes, Planers, Machine Tools, Yachts and Yacht Engines, Water Wheels, Steam Pumps, etc., etc., fully described in our No. 11 list, with prices annexed. Send stamp for copy, stating fully just what is wanted. Forsyth & Co., Machine Dealers, Manchester, N. H.

Patent rights of the Home Carpet Beating Machine for sale. Original patented February 1, 1876, and January 25, 1877. Number of Patents 172,919 and 186,553. Address Chas. Klossner, Patentee, No. 440 Bush St., San Francisco, Cal.

At half price—line cold-rolled shafting; 425 feet, 2½ to 4 inch, with hangers and taper sleeve couplings; good as new. Address Taper Sleeve Coupling & Wooden Pulley Works, Erie, Pa.

Prince's Metallic Paint Company have sold during the past year nearly one thousand tons of their celebrated Prince's Metallic Paint, and not a single complaint has been made as to its quality. For roofs, buildings, etc., it cannot be equalled. For sale by the Trade and by the Company, 166 Fulton St., New York city.

Wanted.—Machine for Cutting Cams about 2 feet diameter. Address, with lowest cash price, Box 2340, N. Y. Yacht and Stationary Engines, 2 to 20 H. P. The best for the price. N. W. Twiss, New Haven, Conn.

Machine Diamonds, J. Dickinson, 64 Nassau St., N. Y.

Parties desiring to establish large or small factories on Water Power, address A. P. Smith, Rock Falls, Ill.

A. J. K., who asked as to drying sand, p. 171, vol. 36: please address Allen H. Bauman, Pittsburgh, Pa.

Glass Monuments, patented Sept. 7, 1875. The whole Patent or State rights for sale. For description and terms, address the inventor, A. Pfeiffer, 15 Ave. A., N. Y.

For Sale.—U. S. Patent No. 187,562, for Traveling Bag Frames. F. Forbes, 165 Broadway, New York.

Flouring Machinery Manufacturers send me Catalogues. J. K. Madden, 11 Cliff St., Jersey City Heights, N. J.

Patent for sale. County or State rights. Self-measuring Fluid Tank. Best in market. Address Box 143, Geddes, N. Y.

New Lathe Attachments, such as Gear Cutting, Tap and Spline Slotting. W. P. Hopkins, Lawrence, Mass.

Amateur Photographic Apparatus, Chemicals, etc. Complete outfits, \$5 to \$25. E. Sackmann & Co., manufs., Brooklyn, N. Y.

Spy Glasses, Mathematical Instruments, Steel Tape Measures, etc. Send for catalogue. W. Y. McAllister, 728 Chestnut St., Philadelphia, Pa.

\$3,500 buys a machine and model shop full of orders. List of tools and particulars sent on application to T. B. Jeffery, 233 Canal St., Chicago, Ill.

Painters.—Send for new prices of Metallic Graining Tools, for "wiping out." J. J. Callow, Cleveland, O.

For Sale.—Combined Punch and Shears, and Engine Lathes, new and second-hand. Address Lambertville Iron Works, Lambertville, N. J.

Gas lighting by Electricity, applied to public and private buildings. For the best system, address A. L. Bogart, 702 Broadway, N. Y.

Power & Foot Presses, Ferracute Co., Bridgeton, N. J.

Superior Lace Leather, all sizes, cheap. Hooks and Couplings for flat and round Belts. Send for catalogue. C. W. Army, 148 North 3d St., Philadelphia, Pa.

F. C. Beach & Co., makers of the Tom Thumb Telegraph and other electrical machines, have removed to 530 Water St., N. Y.

For Best Presses, Dies, and Fruit Can Tools, Bliss & Williams, cor. of Plymouth and Jay Sts., Brooklyn, N. Y.

Lead Pipe, Sheet Lead, Bar Lead, and Gas Pipe. Send for prices. Bailey, Farrell & Co., Pittsburgh, Pa.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing metals. E. Lyon & Co., 470 Grand St., N. Y.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 39 Park Row, New York.

Consumption Cured.—An old physician retired from active practice, having had placed in his hands by an East Indian missionary the formula of a simple vegetable remedy for the speedy and permanent cure for Consumption, Bronchitis, Catarrh, Asthma, and all Throat and Lung affections, also a positive and radical cure for Nervous Debility and all nervous complaints, after having thoroughly tested its wonderful curative powers in thousands of cases, feels it his duty to make it known to his suffering fellows. Actuated by this motive, and a conscientious desire to relieve human suffering, he will send, free of charge to all who desire it, this recipe, with full directions for preparing and successfully using. Sent by return mail by addressing with stamp, naming this paper, Dr. J. C. Stone, 32 North Fifth Street, Philadelphia, Pa.

Steel Castings from one lb. to five thousand lbs. Invaluable for strength and durability. Circulars free. Pittsburgh Steel Casting Co., Pittsburgh, Pa.

For Solid Wrought Iron Benches, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

Skinner Portable Engine Improved, 2 1-2 to 10 H. P. Skinner & Wood, Erie, Pa.

Emery Grinders, Emery Wheels, Best and Cheapest. Awarded Medal and Diploma by Centennial Commission. Address American Twist Drill Co., Woonsocket, R. I.

To Clean Boiler Tubes—Use National Steel Tube Cleaner, tempered and strong. Chalmers Spence Co., N. Y.

Silver Solder and small Tubing. John Holland, Cincinnati, O.

Articles in Light Metal Work, Fine Castings in Brass-Malleable Iron, &c., Japanning, Tinning, Galvanizing, Welles' Specialty Works, Chicago, Ill.

Split-Pulleys and Split-Collars of same price, strength and appearance as Whole-Pulleys and Whole-Collars. Yocum & Son, Drinker St., below 147 North Second St., Philadelphia, Pa.

Foot Power Scroll Saw. W. E. Lewis, Cleveland, O. Wanted.—A first-class Wood Engraver. Address Engraver, P. O. Box 271, Cincinnati, O.

Wanted.—A first-class Mould Maker on Undertakers' Hardware. Address Mould Maker, P. O. Box 397, Cincinnati, O.

Shingle Heading, and Stave Machine. See advertisement of Trevor & Co., Lockport, N. Y.

D. Frisbie & Co. manufacture the Friction Pulley—Captain—best in the World. New Haven, Conn.

Notes & Queries.

G. H. will find a table of the electric conductivities of metals on p. 107, vol. 33.—J. H. will find the proper dimensions of boats in recent numbers of the SCIENTIFIC AMERICAN SUPPLEMENT.—A. W. G. will find a good recipe for brass for small castings on p. 171, vol. 30.—E. S. B. will find directions for making a concrete pavement on p. 185, vol. 33.—A. L. B.'s query as to the manufacture of postage stamps was answered on pp. 208, 277, vol. 27.—J. I. S.'s query as to the telephone is answered on p. 191, vol. 36.—J. C. E. will find a recipe for a depilatory on p. 186, vol. 34.—W. H. J. will find on p. 344, vol. 32, a recipe for cement for marble.—C. E. will find on p. 283, vol. 30, directions for polishing marble.—C. B. will find an answer to his query as to troubles with the feet on p. 123, vol. 33.—C. B. should trace his map on cloth with a pen and Indian ink.—A. E. will find directions for lead burning on p. 167, vol. 32.—E. P. H. will find something on spring power on p. 220, vol. 31.—H. T. P. will find that a remedy for mildew on cloth is described on p. 138, vol. 27.—R. H. H. will find an article on impressions on the retina on p. 193, vol. 36.—G. H. W. can polish German silver by following the directions on p. 37, vol. 34.—J. C. C. can bleach beeswax by the method described on p. 299, vol. 31.—J. H. T. will find something on silvering glass globes on p. 267, vol. 31.—W. T. A. will find a recipe for silverplating on p. 299, vol. 31. For gold plating, see p. 116, vol. 32.—G. should try some of the boiler scale preventives advertised in our columns.—W. T. will find directions for dyeing felt hats black on p. 101, vol. 30.—A. M. P. M. will find an article on the use of compressed air as a power, for locomotive purposes, on p. 277, vol. 34.—G. E. D. will find directions for gliding picture frames on p. 90, vol. 30.—J. V. will find directions for gliding without a battery on p. 116, vol. 33.—C. E. B. will find, on p. 229, vol. 33, something about boilers for small engines. As to horse power of small engines, see p. 33, vol. 33.—J. W. C. will find directions for making soap on pp. 331, 379, vol. 31.—C. A. A. will find something on the manufacture of vinegar on p. 106, vol. 32.—N. L. R., W. C., F. J. B., C. K. W., R. B., J. F. S., J. S., W. M., J. H. N., J. F. McG., G. W. S., F. M. L., and others, who ask us to recommend books on industrial and scientific subjects, should address the booksellers who advertise in our columns, all of whom are trustworthy firms, for catalogues.

(1) H. S. asks: How can I make a platinum chain? How can I melt platinum? A. Pure platinum can only be fused by the aid of the oxyhydrogen blowpipe. Place the metal in a small cavity cut out of a piece of pure caustic lime, and cause the flame to impinge upon it strongly until fused. The hottest part of this flame is, when the gases are properly proportioned, within a quarter of an inch of the mouth of the blowpipe.

(2) C. B. says: You give directions for removing stains of smoke from marble. I have some white marble badly stained with wine and beer. How can I clean it? A. Try the following: Take 2 parts common soda (sal soda), 1 part pumice-stone, and 1 part finely powdered chalk; sift it through a fine sieve, and mix it with water into a paste. Apply this to the stained parts of the marble; and, after a short time, wash clean with water.

(3) E. H. T. says: I found on the Old Millstone Hill, in Worcester, Mass., several fine specimens of fluor spar. I can find no account of its being found before in Massachusetts. A. It has been found in considerable quantities at the Southampton lead mines, and elsewhere.

(4) C. A. F. asks: How can I test a syrup (made from starch) for dextrin or gum? I want to know when the saccharification is complete. The ordinary iodine test will not apply to this case. A. The entire conversion of the dextrin into grape sugar cannot be ascertained with certainty by the iodine test, as in some cases a purple-red tint is observed, while in others there is no change. The most reliable test is that with alcohol, founded on the known insolubility of dextrin in an alcoholic menstruum. To 1 part of the solution to be tested, there are added 6 parts absolute alcohol; if no precipitate is observed, there is no dextrin remaining, and the conversion has been entire.

(5) C. C. S. asks: 1. Why is it that the day does not increase or decrease in length at both ends, by the same number of minutes? A. Taking one half of the year from January 1 to July 2 inclusive, the days increase in length 5h. 44m.; one half, 2h. 52m., is in the morning, the other in the evening. Taking it altogether, there is as much change at one end as the other; but the motion of the earth in its orbit, in combination with its diurnal motion, makes the daily variation sometimes at one end of the day, and again at the other end. 2. Why does the number of minutes added to the day's length vary so? A. They appear to have a daily fluctuation because the seconds are not taken into account. They also have a regular increase or decrease, dependent on the earth's position in its orbit.

(6) E. A. asks: In what position between the lenses which constitute the eyepiece should the diaphragm be placed? A. In the combination at the eye end, it should be in the focus of the eye lens; in the other combination, Fraunhofer placed it in the middle. The French opticians place it about six tenths of the distance between the two lenses, toward the eye end.

(7) C. E. A. asks: Can a person receive a cold from another, under ordinary circumstances, by being in the same room? A. Probably not.

(8) R. W. S. asks: 1. What cheap chemical can be used to change ink to a deep or jet black? A. Try a little solution of extract of logwood. 2. Can aqueduct water be used in place of rain water for making ink? A. Such water may be used if it is clear and not too hard.

(9) J. McC. asks: Is there anything that would answer for a condensing coil in a distillery that would be cheaper than copper, and at the same time be as durable? A. No; copper is best.

(10) A. R. T. asks: Can a drive well be driven in rock? A. Yes.

Is sulphur injurious to leather? A. Sulphur alone is not injurious.

A friend says that the saw does not possess any of the mechanical powers. I say that each tooth acts on the principle of the inclined plane. A. You are right.

(11) D. H. E. says: 1. Professor Silliman, in his "Chemistry," says: Put bicarbonate of soda and water in one end of a strong cylindrical vessel; and in a tube in the other end put sulphuric acid. The arrangement is such that, when the vessel is inverted, the contents mix, and carbonic acid gas is produced. Would it keep therein six months under high pressure? A. Yes. 2. Could a small vessel be made to hold it so long, with rubber or leather packing under the cap screwed on? A. Yes.

(12) C. B. says: Will goldfish live in the water of a fountain, rain or cistern water being used? A. Yes. Sprinkle a few bread crumbs in the water every day.

(13) C. K. asks: 1. Is it injurious to health to sleep in a room containing a rather large amount of green fruit? A. If the room is properly ventilated, you will experience no injurious effects. 2. Does the fruit exhale carbonic acid at night? A. Very little.

(14) J. C. K. asks: What is the diameter of a circle whose area is 1 inch? A. 1.284 inches.

Is there a dictionary of mechanical and chemical words? A. Yes; but as new names are very often coined for new articles or ideas, it is not probable that dictionaries which have been published for some years will have them all.

Why does a circular saw make marks in the lumber at every revolution? A. Because some of the teeth are set wider than the others.

(15) C. R. asks: What is the difference in temperature between the steam and the water in a boiler, under 70 lbs. pressure? A. The difference, in general, is not more than 5° or 6° Fah.

(16) W. T. says: 1. I understand that, if the safety valve of a boiler be raised when the steam pressure is high and the water low, there would be danger of an explosion. If this be so, will you have the kindness to tell me why? A. A sudden escape of steam might carry up some of the water into contact with the overheated plates. 2. In a small yacht boiler, would it be injurious to keep steam down by throwing small quantities of water into the furnace? A. It would be better to use a damper and cover the fire. 3. It is recommended to raise the safety valve to let the air out of the boiler when getting up steam. If this is not done, what would be the consequences? A. The pipes and connections fill with air, which sometimes is troublesome to expel. Considerable instruction as to the duties of an engineer is scattered throughout treatises on the steam engine, as well as through the pages of the SCIENTIFIC AMERICAN.

(17) R. H. T. says: I am running an engine of 62 horse power in connection with three breast wheels of 100 horse power. Owing to back water on the wheels, they are not able to do their work. The regulator of the wheels is disconnected, and the engine does the regulating. How much of the work ought the engine to do, to do the regulating? I claim that the engine ought to hold the balance of power. Am I right? I also contend that, if the engine and the wheels are regulated at 40 lbs. pressure, and the steam goes up to 65 lbs., it is the same as putting more back water on the wheels? Am I correct? After the engine and the wheels are regulated at a pressure of 65 lbs. (this is the amount of steam that she is intended to carry if the steam drops down to 50 lbs.), can she do her work without more water on the wheels? A. Your views, as we understand them, are generally correct. Suppose the whole power is 150, of which the wheels at most do 100, and the engine 50—but that at times the work of the wheels falls off to 88—then, in order that the power may be uniform, the engine must exert 62; and the engine will do the regulating if it can change its power promptly, within the limits of the variation in the power of the wheels.

(18) A. S. asks: What ingredients and proportions are used to produce the different shades of light so often used in theaters? A. We give below a table of the composition of the mixtures commonly employed for colored fires in tableaux, etc. These fires, however, should never be used within doors, as the gaseous products of some of them are extremely poisonous (see articles on pp. 84 and 171, vol. 36). The lime light lanterns and lenses of suitably colored glass have now been generally substituted for these fires, and give much better results.

	a	b	c	d	e
	Green	Red	Yellow	Blue	White
Chlorate of potash...	32.7	20.7	54.3	54.3	30
Sulphur	9.8	17.2	23.6	18.1	
Charcoal	5.2	1.7	3.8		
Nitrate of baryta...	52.3				
" " strontia...		45.7			
" " soda...			9.8		
Ammonium sulphate of copper			62.8	27.4	60
Saltpeter					
Black sulphide of antimony		5.7			5
Floury gunpowder					15

It is hardly necessary to mention that great care is required in mixing these materials, and that each should be pulverized separately.

(19) R. A. asks: Does the Dipper revolve around the North Star? A. No. The Dipper and North Star are on opposite sides of the pole, and as regards each other are very nearly stationary. They both have

two apparent revolutions around the pole, one every day, which is due to the diurnal revolution of the earth on its axis, the other once a year, which is due to the annual motion of the earth in its orbit around the sun.

(20) R. N. says, in answer to H. M. C., who asked: If the three sides of a triangle be given, what is its area? Consider the longest side the base; from the square of the base take the product of the sum and difference of the other sides, and divide the remainder by twice the base; multiply the square of the base by the product of the sum and difference of the shortest side and the quotient; half the square root of the result will be the area. Example: Let the sides be 10, 7, and 5;

$$100 - (10 \times 2) = 80, \text{ and } \frac{1}{2} \sqrt{100 \times 80 \times 12} = \frac{1}{2} \sqrt{10000} = 11.41 +, \text{ for the area.}$$

(21) C. asks: What is the best cement for rubber bags, to be used for hot water? A. Dissolve caoutchouc, cut into small fragments, in naphtha, by heat and agitation. Strain this solution through a linen cloth and concentrate to the consistency of a thin paste. The cement is best applied slightly warm, and the joint strongly clamped between strips of wood for 24 hours before using.

(22) G. S. asks: What will take the smell out of porpoise oil? A. Agitate the oil with about 3 per cent of sulphuric acid, and then with 10 per cent of chloride of lime (hypochlorite of lime) while moderately hot. Finally wash thoroughly with hot water and allow to settle. This treatment will not completely deodorize the oil, but it will correct all rancidity.

(23) L. H. says: 1. I have an engine of ½ horse power, which I would like to put into a boat 30 feet long of 5 feet beam. Is it powerful enough to propel said boat at the rate of 8 miles an hour? A. No. 2. How can I learn the signals of the steamboat whistle, such as the pilots use? A. We advise you to interview a boatman.

(24) S. S. C. asks: 1. In a silver-plating bath, should the surface of anode immersed equal the surface of cathode? A. They should be about alike. 2. Is there any way of testing the amount of free cyanide in a plating solution? A. Yes. See Sprague's "Electricity; its Theory, Sources, and Applications." 3. In a nickel ammonia sulphate solution, does the ammonia or acid act upon the nickel anode to keep the strength of the solution up? A. The acid.

(25) D. A. R. says, in answer to E. L., who asked of what diameter should drills be to fit ¼, ½, etc., pipe taps, I send you a table and rule for computation. The outside diameters are from Morris and Tasker's table of standard sizes.

Inside diameter.	Outside diameter.	Outside allowing for the taper.	Diameter at bottom of thread — size of drill in inches.
¼	.305	.262	.258
½	.54	.497	.491
¾	.875	.832	.826
1	1.315	1.272	1.266
1 ¼	1.96	1.916	1.91
1 ½	2.375	2.332	2.326
2	2.875	2.832	2.826
2 ½	3.437	3.394	3.388
3	4.0	3.957	3.951
3 ½	4.5	4.460	4.454

The taper used in calculating is that given by Pratt and Whitney, 1 inch to foot and the length of threads on ¼ to ¾ is ¼ inch, ¾ to 1 is ¾, 1 ¼ to 2 is 1, and 2 ½ to 4 inches is 1 ¼ inches. The rule for computing size of drills is: Subtract from the outside diameter (after allowing for the taper) the product of the pitch by 1.732, which gives the diameter at the bottom of the thread, or the size of the required drill.

(26) M. C. H. says: I am building a time regulator and want to make a mercurial compensating pendulum to beat seconds. The rod is to be of steel, and the bob a glass tube filled with mercury. At what height must the mercury stand in the tube to compensate correctly? A. You will have to determine the exact height by experiment. It will probably be between 6½ and 6¾ inches.

(27) G. W. J. says: I have been making a plain cylindrical boiler, without flues. It is 9 inches in diameter and 20 inches long, of No. 18 galvanized iron. The seam is lapped 1½ inches, and riveted with 2 rows of iron rivets, ¼ of an inch in diameter, 35 in each row, and the rows are ½ inch apart; the edges of the iron are soldered inside and out. The heads are of cast iron ¼ inch thick, with flange ¼ inch thick and ¼ inch wide, to receive rivets. Each is riveted with 56 iron rivets ¼ inch in diameter. Where is the weakest point, and at what pressure would it be safe to run it for a small engine? A. The heads are probably the weakest parts. Working pressure, 30 lbs. per square inch.

(28) J. R. S. says: I claim that, when the gauge on a steam boiler shows a pressure of 10 lbs. or upwards to the square inch, that the pressure is equal on all parts of the boiler. A friend claims that it is not. Who is right? A. The one who claims that the pressure is not the same on all parts of the boiler, is correct.

(29) J. W. P. asks: 1. If a wind wheel be put at the mouth of a bellows, will it not have power enough to replace more air into the bellows than it takes to turn the wheel? A. No. 2. If the wheel is to be 2 feet in diameter and a pulley on its axle be 6 inches in diameter, will it not run the lever to work the bellows? A. No.

(30) I. says: An inventor of a steam boiler states that he has used his boiler for eighteen months with muddy water, and that on inspection he finds no scale or sediment, although the boiler has never been blown off. He claims that all sediment and scale-forming impurities of the water pass off with the steam into the cylinder of the engine. He states that his boiler primes less than two per cent. What experience have you that makes it credible that a boiler that will not prime will carry the sediment into the cylinder? A. A chemist has told him that the scale-forming impurities, both of salt and fresh water, will not injure the cylinder, but will act as lubricators. Is this true of all scale-forming impurities? A. These statements are not verified, in general, by experience.

(31) S. U. says: We have a cast iron sectional steam boiler, for heating. As soon as the steam gauge commences to indicate pressure, the water leaves the boiler and goes off in the supply pipes. Can you tell us how to remedy this? A. As we understand you, the water goes from the boiler to the heating pipes, and then returns. We presume this is what is intended. If not, it is probable that the insertion of a valve will prevent the escape of the water.

(32) M. M. C. asks: 1. Which is best for annealing cast iron—charcoal or bituminous coal, and why? A. Charcoal, generally, as it contains less impurities. 2. What is the formula for calculating the tensile strain on the iron of a boiler shell, diameter of boiler, thickness of shell, and pressure of steam being given? A. See Van Buren on the "Strength of the Iron Parts of Steam Machinery." 3. How many square feet of heating surface in a boiler are generally required for a horse power? A. We do not know what is meant by the horse power of a boiler. 4. Is an oblique cone, that is, a cone whose axis is inclined to the plane of its base, measured by the area of its base into $\frac{1}{2}$ the perpendicular height? A. Yes. 5. What is the formula for finding the volume of a cylinder? A. Area of base multiplied by altitude.

(33) G. T. P. says: 1. I have a glass tube $\frac{1}{4}$ inch inside diameter. How many inches shall I have to raise the mercury in it to equal 1 lb. pressure? A. Height of column $2\frac{1}{2}$ inches. 2. How much mercury shall I use? A. Volume of mercury, about $\frac{1}{16}$ of a cubic inch.

(34) F. L. asks: 1. Could I boil about 45 gallons of linseed oil in a large copper vessel, by having the steam and the steam pipe running into the oil, or would the water from the condensed steam affect the oil? A. No; some of the steam would condense in the oil. 2. Do you think it would take any more than one or two barrels of oil (of 45 gallons each) to varnish a 40 foot balloon, giving it three or four coats of the varnish? A. The quantity would be amply sufficient. 3. Would linseed oil, that is sold already boiled, do for a balloon varnish, just by painting it on the balloon when it is cold, or should I warm it up to some degree? A. No. 4. Do you think it improves linseed oil varnish to put beeswax in it when boiling, say about 1½ ozs. to the gallon? A. No. 5. Boil the oil with the addition of $\frac{1}{4}$ lb. of borate of manganese (in powder), and about 5 lbs. of beeswax to the barrel, and apply to the cloth slightly warm. 6. Is it best to varnish the muslin once before it is cut, and once after the balloon is made, to cover the needle holes, or to put no oil on the muslin until it is all made up? A. Give it one coat before and one or two afterward. 7. Would the black gum waterproofs, that the ladies wear in damp weather, do for making balloons? A. The material will not answer.

(35) N. V. says: I have been trying to make ink according to the recipe on p. 250, vol. 34, SCIENTIFIC AMERICAN, and found that it washed off. I thought that perhaps there was too much of the sulphate of indigo, and I increased the quantities of nutgalls and copperas one half; but it still washes off. What is the difficulty? A. If we understand you, the ink in question was not intended to stand washing with water. Judging from your letter, you have nothing to complain of, as the ink as made by you from the recipe mentioned compares very favorably with the best inks of this character in the market.

(36) W. S. asks: In building a residence, is there anything that is of value as preventing conflagration from sparks on shingle roofs? A. There is an asbestos paint that is said to answer the purpose very well.

(37) A. E. R. says: 1. I desire to burn some of the old style burning fluid. How can I make it? A. Use alcohol mixed with one fifth of turpentine or benzine. 2. Will it be dangerous to use with a blow-pipe? A. It is not dangerous when used in suitably constructed blow-pipe lamps.

(38) G. H., Jr., asks: 1. How would hard blue burnt brick, set endwise in cement mortar, answer for a public street with heavy traffic, if the brick resists a crushing power of 8,000 lbs. to the square inch? A. It is not resistance to crushing so much as resistance to impact that is required in a good paving material, and the latter quality is not possessed even by the hardest brick. The hammering process that the pavement of a busy thoroughfare undergoes would be fatal to the permanency of brick construction—the effect upon the brick being to pulverize its surface. 2. What effect would the hot and cold weather have on a layer of cement 1 inch thick under the brick, and $\frac{1}{4}$ inch all round the sides of them, built in arch shape? A. When the cement is once set, it would not be materially affected by temperature.

(39) R. C. asks: How many degrees of Fahrenheit does it require to hatch chickens' eggs? A. From 104° to 106° Fah. is the proper temperature. You will find an article on this subject on p. 849 of SCIENTIFIC AMERICAN SUPPLEMENT, No. 54.

(40) B. A. asks: Can you tell us the best method of making concentrated lye from ashes? A. Collect the ashes of well burnt wood, place them in a suitable vessel, and leach with water for several days, with occasional stirring. Then transfer the clear liquid to a suitable clean iron vessel, and boil off the water. Collect the impure carbonate of potash thus obtained, mix it with half its weight of slaked lime and 15 parts of warm water, stir for a few minutes, allow to settle, and pour off the liquid. This liquid constitutes common caustic lye. A lye may also be obtained by treating ordinary pearlash or carbonate of soda (sal soda) with lime and water, as stated.

(41) J. A. L. asks: How can I make a photographic camera? A. The simplest form is a box with a pinhole in one end and the photographic plate at the other. The next higher order is to insert a convex lens in the end (where the pinhole is) with a focus equal to the length of the box. From this to as many as six lenses are used to constitute the optical part, these being arranged with diaphragms, rack and pinion, etc. The boxes (from the above simple form) have an endless variety of forms: the bellows, the swing front, the elevating front, the swing back in several varieties, then the multiplying box, in which from one to one dozen pictures

may be made at one sitting; and the shield which holds the plate has many modern improvements.

(42) E. D. F. says: I am constructing a filter of 11 pipes, made of cedar wood, packed very solidly with fine powdered charcoal, sand, and gravel. The water passes through 121 feet of filtering material which is arranged in sections which can be cleaned or renewed every month. Our river water is the worst in the United States, extremely muddy for six months in the year; but it comes through the charcoal as clear as from a mountain spring. I want to put a tank above the filter, square or oblong in shape. What metal shall I line it with, or of what material shall I make it? A. A cast iron tank would answer your purpose. Plates 18 by 18 inches and 18 by 9 inches are kept in stock for this purpose; they are provided with flanges around their edges, by means of which they are put together with bolts.

(43) S. G. says: Why is it that sewer gas finds its way through the traps into houses? Is it because the traps siphon? Or does the pressure of the sewer gas force the water out of the trap, or forces its way past or through the water? A. To remedy the pressure of sewer gas, which forces itself through the water in the traps into the rooms of your house, let the main waste pipe extend without obstruction from the sewer up through the roof to discharge its surplus air into the atmosphere there. Then let the several articles of plumbing have branch waste pipes, and each one be trapped as near to its opening as possible. The upper part of said main waste pipe being only an air pipe, may be of much less diameter than the lower part, which it is necessary to have of larger dimensions.

(44) T. B. says: I recently had to put on a false valve seat on a locomotive. There had been one on before, but I put the new one on differently, leaving three of the old holes in the cylinder. I filled these with Babbitt metal hammered carefully; and I made the metal flush with the surface, put on the seat, and took all precautions to make a good job. When the engine went on the road she "blowed" badly, and continued to get worse, so much so that I had to take the seat off again; and when off, I found the Babbitt metal raised above the surface of the old seat fully $\frac{1}{8}$ of an inch. Two of the old holes were between set screws $\frac{1}{2}$ inches apart, and one between screws $2\frac{1}{2}$ inches apart, and the two were considerably higher than the one. Is it possible for the metal to expand so much as to cause that seat to leak? A. No doubt the leak was caused by the expansion of the Babbitt metal.

(45) R. M. says: I wish to sink a well in order to provide myself with wholesome water. At what distance must I keep from a privy well in rear of my house? The soil is very stiff clay, and I dug my privy well 16 feet deep to secure good soakage. A. Locate the well as far as possible from the cesspool, at least 50 feet from it. Let the well be 3 feet diameter in the clear after it is stoned up, and provide at the top two lengths of well-curb, 3 feet high each, to keep out the surface water. The depth of the well will depend upon the depth at which clear water runs in the ground in your locality. You had better employ a professional well-digger, who will contract to dig your well and stone it up at a certain price per foot in depth. The cucumber pump is highly spoken of.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the result stated:

G. H. M.—It contains pyrolusite (oxide of manganese).—H. B.—It is clay slate.—H. M. A.—It appears to consist principally of wood pulp, chalk, a little Vandyke brown, and glue.—J. F. L.—It consists principally of copper with some zinc. You should send larger specimens.—J. L. R., Jr.—It is marmolite, a variety of serpentine. It contains silicate of magnesia, magnesia, a trace of iron, and water. It is of common occurrence. It has been employed in the manufacture of Epsom salts, and, when in large, perfect pieces, as material for ornamental vases.—W. H. C.—It is galena—sulphide of lead—a valuable lead ore. It contains about 80 per cent of available metal.

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On Micro-Photographs, etc. By C. M.
On Combustion in Lamps. By A. K. S.
On Aerial Propulsion. By L. C.
On Squares and Cubes. By E. H. B.
On Lightning Rods. By J. M. M.
On the Ball and Jet Puzzle. By H. G. W.
On Kerosene Lamps. By E. B. W.
On Boiler Explosions. By D. R., and by G. B. B.
On Mountains in the Moon. By P. E. S.
On Steam Engine Economy. By W. A. M.
On the Gyroscope. By J. M. A.

Also inquiries and answers from the following:
H. M. P. W. C.—E. P. S. A.—W. H.—J. C. S., Jr.—C. J. K.—G. C.—G. M.—C. M.—F. R. N.—A. J.—N. J.—A. B. C.

HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Inquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of inquiries analogous to the following are sent: "Who rolls thin plates of spring steel, of large size and without flaws? Who makes castings to order? Who is the best theodolite? Who makes the best recording pressure gauge? Who makes the best steam engine for running small machines? Who sells horse power pumps?" All such personal inquiries are printed, as will be observed in the column of "Business and Personal," which is especially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

OFFICIAL.

INDEX OF INVENTIONS

FOR WHICH
Letters Patent of the United States were
Granted in the Week Ending

March 20, 1877,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

Alarm and register, J. Corbett.....	138,597
Album, A. Foerste.....	138,597
Asphaltum, liquid, A. K. Lee.....	138,597
Bag fastener, H. Redden.....	138,597
Baggage check, R. F. Livermore.....	138,597
Ball car, bucket, C. D. Seys.....	138,597
Ball car for palls, etc., P. Miles.....	138,597
Bale ties, S. N. Drake.....	138,597
Bale tie, J. S. Durning.....	138,597
Bale tie, J. H. Fisher.....	138,597
Bale tie, J. M. Pollard.....	138,597
Bale tie, cotton, W. M. Smith.....	138,597
Baling press, W. S. Coates.....	138,597
Barrels, head lining for, L. Reed.....	138,597
Bed bottom, spring, Oghorn & Kendrick.....	138,597
Bedstead, sofa, F. A. Coleman.....	138,597
Bedstead, invalid, J. P. Beaman.....	138,597
Bench plane, Traut & Richards (r).....	138,597
Hill file, C. C. Chamberlain.....	138,597
Binder, temporary, L. Richoux.....	138,597
Blacksmith's machine, J. C. Tobin.....	138,597
Blast furnace, charging, C. Himrod.....	138,597
Blue glass sun bath, H. M. Beldier.....	138,597
Boiler tube plug, T. R. Hand.....	138,597
Book binding, F. E. Schmitz.....	138,597
Box trimming machine, C. Bopp.....	138,597
Boxes, manufacture of, F. Zuenkel.....	138,597
Brick, etc., coal slack for, B. H. Warburg.....	138,597
Bridge joint, T. Ruick.....	138,597
Brush, J. P. Poland.....	138,597
Buckle, B. F. Melton.....	138,597
Button tab, A. Berndt.....	138,597
Calendar, E. P. Morse.....	138,597
Can, metallic, R. T. Bush.....	138,597
Can top with opener, A. E. Whitehead.....	138,597
Car axle lubricator, H. Gardner.....	138,597
Car, freight and stock, J. R. Maitland.....	138,597
Car coupling, J. A. Hinson.....	138,597
Cars, extension step for, C. W. Perkins.....	138,597
Cars, running gear for, L. T. Pyott.....	138,597
Carburetor, Pierce & Smiley.....	138,597
Card rack, J. P. Lamoree.....	138,597
Casting car wheels, W. Wilmington.....	138,597
Chandelier, extension, L. Hull (r).....	138,597
Check rein spread, etc., D. Schoonmaker.....	138,597
Check rower, W. Flaherty.....	138,597
Chimneys smoking, preventing, J. R. Bowers.....	138,597
Cigar bundle, I. A. Wilson.....	138,597
Cigar machine, J. S. Winsor.....	138,597
Cigarette mouth piece, J. R. Saunders.....	138,597
Clutch shaft gearing, W. Adair.....	138,597
Coal washing machine, S. Stutz.....	138,597
Coin detector, counterfeit, J. Wladia.....	138,597
Coin, means for packaging, H. Crogon.....	138,597
Coin tester, G. M. Hopkins.....	138,597
Collar box, metallic, G. K. Snow.....	138,597
Convicts' shackles, J. L. Quackenbush.....	138,597
Copping press, R. E. Kidder.....	138,597
Corn planter, M. O. Skree.....	138,597
Corn planter, Tatlock & Newby.....	138,597
Corn row marker, T. A. Cole.....	138,597
Corset, S. F. Follette.....	138,597
Corset, M. W. Henius.....	138,597
Cotton press, W. Golding.....	138,597
Cradle, G. Buchanan.....	138,597
Cultivator, Ellwood & Pitcher (r).....	138,597
Curtain fixture, J. H. Strothman.....	138,597
Curtain roller, A. F. Temple.....	138,597
Ditching machine, T. N. & S. Turner.....	138,597
Door hanger, barn, J. H. Lawrence.....	138,597
Draft equalizer, Fowler & Plagg.....	138,597
Draft equalizer, H. L. Phelps.....	138,597
Elevator bucket, F. C. Barber.....	138,597
Engine gearing, H. Stubbs.....	138,597
Eraser tip and pencil protector, G. W. McGill.....	138,597
Evaporator, I. W. Parmenter.....	138,597
Evaporator, salt water, H. C. Bowers.....	138,597
Faucet, H. Bradley.....	138,597
Feather renovator, J. C. Divers.....	138,597
Fence picket, corrugated, B. F. Miller (r).....	138,597
Fence wire, barbed, Glidden & Vaughan (r).....	138,597
Filter, V. Dordet.....	138,597
Fire arms, tool for, W. G. Rawbone.....	138,597
Fire escape, Lyness & Dunne.....	138,597
Fire kindler, O. A. Trevaloe.....	138,597
Fishing trap, S. M. Davis.....	138,597
Flour chest and bread table, W. A. Baines.....	138,597
Fluting and smoothing iron, Crocker & Farns.....	138,597
Fluting machine, J. E. Wilson.....	138,597
Foot scraper and cleaner, Ellis & Willis.....	138,597
Fruit can, J. F. Merrill.....	138,597
Furnace for thawing leaders, W. R. Ostrander.....	138,597
Furnace feeder, E. F. Littlepage.....	138,597
Furniture spring, H. H. Holmes.....	138,597
Furrowing ground, N. C. Hammell.....	138,597
Gas, making, A. C. Lippitt.....	138,597
Gas retort, G. W. Todd.....	138,597
Gasoline burner, F. Marquart.....	138,597
Grain binder, E. Heath.....	138,597
Grain separator, H. Kurth.....	138,597
Grinding apparatus, etc., J. J. Lancaster.....	138,597
Hame fastener, C. F. Whipple.....	138,597
Harness breast plate, W. Dyer.....	138,597
Harrow, N. Burnham.....	138,597
Harrow, J. Garrett.....	138,597
Harvester reel, Weed & Bell.....	138,597
Hat, adjustable, I. Y. Cassiano.....	138,597
Heat, etc., storing, Hittell & Deitzler.....	138,597
Heater, E. Chadwick.....	138,597
Hinge, spring, J. M. Jones.....	138,597
Horse collar, C. H. Stevens.....	138,597
Horse hay rake, S. Ritty.....	138,597
Horse power, W. H. House.....	138,597
Horses, detaching, N. Dexter.....	138,597
Horses, hitching, A. B. Wroth.....	138,597
Horseshoe, J. B. Going.....	138,597
Hydrant, J. Richardson.....	138,597
Injector for steam boilers, J. Westley.....	138,597
Ironing apparatus, H. E. Smith.....	138,597
Knitting machine, C. H. Landenberger.....	138,597
Lamp, J. C. Mairs.....	138,597
Lamp, L. H. Oimsted.....	138,597
Lamp, C. Reistle.....	138,597

Lamp burner, A. Angell.....	188,490
Lamp chimneys, crimping, A. Harcum.....	188,626
Lamp, fountain, W. A. Butler.....	188,584
Lamp, miner's, J. J. Weinel.....	188,765
Land roller, L. M. Stegner.....	188,484
Lapping machines, J. Batty.....	188,495
Lawn sprinkler, J. S. Heacock.....	188,628
Lever clamp, V. Yantis.....	188,718
Lifting jack, carriage, etc., G. S. Jones.....	188,467
Light house signal, C. G. Van Otter.....	188,700
Line fastener, J. Thomas.....	188,485
Lock and chain fastening, C. Parham.....	188,664
Loom shuttle, C. W. Anderson.....	188,460
Loom shuttle, A. Wright.....	188,480
Loom temple, Porter & Clark.....	188,638
Loom shuttle box motion, J. Long, Jr.....	188,623
Lounge, J. J. Coburn.....	188,492
Lubricating compound, P. M. Papin.....	188,479
Magazine fire arm, J. W. Keene.....	188,468
Mangle, H. E. Smith.....	188,695
Mechanical movements, J. A. House.....	188,464
Metal working machine, R. Bandhauer.....	188,494
Milk strainer, J. A. Preston.....	188,420
Millstone dress, diamond, Wilhelm & Davis.....	188,767
Mitering machine, Mosher & Pennington.....	188,678
Motor, E. McCaffrey.....	188,570
Mucilage holder, S. S. Newton.....	188,629
Oil cabinet, J. A. Wright.....	188,560
Oiler nozzle, S. S. Newton.....	188,628
Ore feeder, quartz mill, G. A. Church.....	188,587
Oven, A. Crumble.....	188,600
Packing, hydraulic, C. E. Boardman.....	188,466
Packing for man holes, etc., A. Powell.....	188,480
Paper, buffing roll for, A. D. Pool.....	188,670
Paper pulp washer, G. L. Lovett.....	188,474
Paraffin wax, purifying, F. X. Byerley (r).....	7,559
Pavement, concrete, L. S. Filbert.....	188,614
Pavement, concrete, A. K. Lee.....	188,645
Pegging awl handle, A. U. McDonald.....	188,530
Pencil, pocket, D. M. Somers.....	188,721
Piano action, Wessell, Nickel & Gross.....	188,706
Piano fortes, stringing, P. Brenner.....	188,579
Pick eyes, forming, Jordan & Kenold.....	188,643
Plaiting board, Young & Calvert.....	188,561
Planter, L. Scofield.....	188,547
Plow, E. D. French.....	188,508
Plow, E. Wiard.....	188,555
Plow, gang, H. H. Canaday.....	188,586
Plow shoe, M. H. Walker.....	188,701
Pocket book clasp, S. F. Clement.....	188,589
Post office box, J. B. Harlow.....	188,512
Potato vines, sprinkling, J. Williams.....	188,487
Preserving meat, etc., T. Sim (r).....	7,564
Privy seat, R. A. Van Court.....	188,609
Pruning shears and saw, T. S. Diston.....	188,604
Puddling furnace, rotary, J. I. Williams.....	188,488
Pump, Olsen & Thuesen.....	188,524
Pump, L. D. Rallsback.....	188,481
Pump, J. J. Stuart.....	188,692
Railway chair and tie, N. S. White.....	188,710
Railway gate, S. P. Boston.....	188,574
Railway rail, J. Foster.....	188,617
Ratchet brace, W. B. Smith.....	188,604
Reefing sails, O. W. Atwood.....	188,491
Refrigerating shipping box, H. A. Duc, Jr.....	188,600
Refrigerator, G. A. Banta.....	188,488
Refrigerator, J. J. Bate.....	188,567
Refrigerator, H. E. Fuller.....	188,509
Refrigerator and filter, A. McClain.....	188,650
Rein holder, W. Callaway.....	188,588
Rice cleaning machine, J. Carter.....	188,489
Roaster and warmer, H. S. Graham.....	188,463
Rolling metal, W. Bunton.....	188,498
Rolling mill, P. McGinn.....	188,476
Salt boilers, rake for, J. E. Secord.....	188,680
Sash holder, H. C. Gladding.....	188,511
Scales, weighing, H. Willard.....	188,567
Scissors, A. W. Coates.....	188,590
Screw, J. Plenkhar.....	188,668
Screw cutting die stock, J. Hochheimer.....	188,634
Screw tap, M. C. Johnson.....	188,466
Seaming machine, W. Hipperling.....	188,603
Sewing machine, O. S. Hazard.....	188,514
Sewing machine, D. Porter.....	188,537
Sewing machine glove, H. P. Henriksen.....	188,515
Sewing machine needle, L. Loeske.....	188,548
Sewing needles, pointing, P. M. Beers.....	188,549
Shears and scissors, A. Delkescamp.....	188,601
Shirt, O. H. Keep.....	188,640
Shirt, G. P. Marvin.....	188,528
Shoe bottoms, etc., forming, E. M. Dickinson.....	188,603
Sickle grinder, W. S. Ingraham.....	188,639
Sickle sections, tempering, S. F. Reynolds (r).....	7,563
Signal lantern, H. E. Pond.....	188,671
Sink and sewer trap, J. H. Mackie.....	188,652
Skirt supporter, C. V. Richards.....	188,675
Skylight, Specht & Spieler.....	188,605
Slate and scholar's companion, W. D. McCormick.....	188,651
Sleigh runner, wagon, T. Grissinger.....	188,621
Smoke consuming furnace, H. Young, Jr.....	188,719
Snap hook, E. P. Brennan.....	188,578
Spice box, H. J. White.....	188,710
Steam generator, H. C. Bowers.....	188,575
Stone composition, M. Nolan.....	188,600
Stone, compound for, C. Schaffer.....	188,679
Stove cover, G. N. Bacon.....	188,564
Stove drum, J. Hacker.....	188,622
Stove for heating and ironing, R. Martin.....	188,475
Straw cutter, Larsen & Olsen.....	188,530
Stamp extractors, A. McKenney.....	188,634
Suppository mould, H. W. Comstock & Co.....	188,655
Suspenders, J. Betts.....	188,712
Textile material, etc., cutting, A. Warth.....	188,702
Thill coupling, Farrell & Borst.....	188,613
Thill coupling, Owen & McClintock.....	188,660
Time lock, L. A. Haines.....	188,638
Tire tightener and jack, Comstock & Co.....	188,595
Tobacco and cotton press, A. Talbott.....	188,606
Tobacco hanger, J. G. Hester.....	188,631
Tobacco pipe cover, G. Havell.....	188,627
Toilet washing powder, B. Schmers.....	188,549
Toy, educational, E. S. Fisher.....	188,606
Toy, jumping, G. Boeringer.....	188,461
Toy money box, L. C. Hoffmeister.....	188,635
Truck, safety car, D. E. Dutrow.....	188,611
Tubing, armor for flexible, H. Wakeman.....	188,584
Valve, relief and safety stop, C. P. Wiggins.....	188,586
Vehicle axle, P. F. White.....	188,709
Vise, W. B. Snediker.....	188,668
Wagon bed and hay rack, J. M. O'Neal.....	188,661
Wagon dumping, H. A. Reed.....	188,541
Wash board, J. H. Lapham.....	188,472
Wash board, W. Service.....	188,681
Washing machine, F. H. Cooney.....	188,596
Washing machine, J. Kieble.....	188,479
Washing machine, G. D. Luce.....	188,524
Washing machine, J. Taylor.....	188,636
Water closet, H. J. Bailey.....	188,499
Welding chain, die for, Schmeller & Fitzpatrick.....	188,545
Wind wheel, J. A. Allen.....	188,563
Wood polishing machine, Bridgman & Perry.....	188,580
Work box, W. Huntress.....	188,510
Wrench, J. A. Dodge.....	188,620

Advertisements.

Inside Page, each insertion --- 75 cents a line.
Back Page, each insertion --- \$1.00 a line.
Engravings may be inserted at the same rate
per line, by measurement, as the letter press. Adver-
tisements must be received at publication office as early
as Friday morning to appear in next issue.

THE NEW ENGLISH SCIENTIFIC
and Technical Books Imported and kept in stock.
Our new and enlarged CATALOGUE of PRACTICAL
AND SCIENTIFIC BOOKS—56 pages, 8vo.—and other lists,
sent free to any one who will furnish his address.
HENRY CAREY BAIRD & CO.,
Industrial Publishers, Booksellers, and Importers,
810 Walnut Street, Philadelphia.

THE DINGEE & CONARD CO'S BEAUTIFUL EVER-BLOOMING ROSES

Strong Pot Plants, suitable for immediate flowering,
sent safely by mail, postpaid. 5 splendid varieties,
your choice, all labeled, for \$1.12 for \$2.19 for \$3.12 for \$4.35 for \$5. For 10 cents each additional, one
Magnificent Premium Rose to every dollar's worth
ordered. Send for our NEW GUIDE TO ROSE
CULTURE, and choose from over 300 finest sorts.
We make Roses a Great Specialty, and are the largest
Rose-growers in America. Refer to 100,000 customers in the
United States and Canada. **THE DINGEE & CONARD**
CO., ROSE-GROWERS, West Grove, Chester Co., Pa.

MACHINERY
OF EVERY DESCRIPTION.
The George Place Machinery Agency
121 Chambers & 103 Reade Streets, New York.

Important to Watch Manufacturers!
The Lancaster Watch Company's Works for sale or
lease. All the Machinery, Tools, Material, and Manu-
factured Stock for sale, in whole or in part, together with the
right to use Perry's Patent Stem-winder and click.
Catalogues furnished on application to
A. BITNEP,
Lancaster, Pa.

PERFECT NEWSPAPER FILE

The Koch Patent File, for preserving newspapers,
magazines, and pamphlets, has been recently improved
and price reduced. Subscribers to the SCIENTIFIC AM-
ERICAN and SCIENTIFIC AMERICAN SUPPLEMENT can be
supplied for the low price of \$1.50 by mail, or \$2.25 at the
office of this paper. Heavy board sides; inscription
"SCIENTIFIC AMERICAN," in gilt. Necessary for
every one who wishes to preserve the paper.

MUNN & CO.,
Publishers SCIENTIFIC AMERICAN.

BENTEL MARCEDANT & CO.
MANUFACTURERS OF
SUPERIOR
UNIVERSAL WOOD WORKERS
BAND SAWS, SCROLL SAWS
PLANING & MATCHING MACHINES
UNIVERSAL HAND JOINTERS
MOLDING, DOVETAILING, BORING, RITZING, SHAPING &
HAND PAIRING MACHINES, PLANE KNIVES & MOLDING BITS
HAMILTON, OHIO.

IRON PLANES, DRILL PRESS, FOOT PRESS, AND
two Engine Lathes for sale cheap by
A. A. POOL & CO., 55 R. R. Ave., Newark, N. J.

DIATOMS!! Fine slides by new process. Va., Md. and
Cal's. 60c. ea.; 4 for \$2. Circular free. C. L. PETICOLA,
65 5th St., N. B., Va.

THE DRIVEN WELL.

Town and County privileges for making Driven
Wells and selling Licenses under the established
American Driven Well Patent, leased by the year
to responsible parties, by
WM. D. ANDREWS & BRO.,
NEW YORK.

DEAFNESS RELIEVED. No medicine. Book
free. G. J. WOOD, Madison, Ind.

**MANUFACTURE OF ARTIFICIAL BUT-
TER.**—By Prof. Henry A. Mott, Jr., E.M. With six en-
gravings.—Being a History of the Artificial Butter
Manufacture, Descriptions of the Principal Processes
now in use, Details of Latest Improvements, Plan of an
Artificial Butter Factory, Engravings of the Machinery
required, Chemical Analyses of Butter and of Artificial
Butter, Details of the Costs of setting up an Artificial
Butter Factory, the Capital required, the materials and
quantities consumed, Cost of manufacture per pound,
the Daily Profit, etc. A complete and reliable treatise
contained in SCIENTIFIC AMERICAN SUPPLEMENT Nos.
48 and 49. Price, 10 cents each. To be had at this office
and of all newsdealers.

Kleinau's Universal Security Lock,
of Kleinau & Co., Hamburg (Germany),
patented in all States of Europe and America.
Its prominent advantages consist in absolute security,
greatest simplicity, durability, elegance, general application,
and cheapness of production, so far not even approxi-
mately equalled by the construction of any other security
lock.
The firm of Kleinau & Co. possess for the United States
of America a patent for a period of seventeen years, and
they are disposed to entertain propositions as to its sale.
Please address offers directly to
KLEINAU & CO.,
Manufacturers of Security Locks, Hamburg (Germany).

LEFFEL WATER WHEELS.
With recent improvements.
Prices Greatly Reduced.
7000 in successful operation.
FINE NEW PAMPHLET FOR 1877,
Sent free to those interested.
James Leffel & Co.,
Springfield, O.
109 Liberty St., N. Y. City.

FOR SALE.

A large assortment of new and second-hand Engines,
condensing and non-condensing, from 5 to 300 indicated
horse power. Also a large assortment of new and second-
hand tools, all of our own make, and at prices to suit the
times. Orders for new work promptly attended to.
Address
HEWES & PHILLIPS IRON WORKS,
Newark, N. J.

N. F. BURNHAM'S
1874
WATER WHEEL
Is declared the "standard turbine,"
by over 600 persons who bought and use
them with part and full gate open.
Pamphlets Free.
N. F. BURNHAM, York, Pa.

OTIS' SAFETY HOISTING
Machinery.
OTIS BROS. & CO., No. 38 Broadway, New York.

50 Visiting Cards, with name, life and stamp.
Ag'ts Outfit No. 1. L. C. COE & CO., Bristol, Ct.

FRICITION CLUTCHES
AND ELEVATORS.
VOLNEY W. MASON & CO. PROV. R.I.

RISDON'S IMPROVED
TURBINE WATER WHEEL
Yielded at the test of Turbines at Centennial
Exposition the best results at all stages
of gate. Send for circular to
T. H. RISDON & CO.,
Mt. Holly, N. J.
Manufacturers of MILL MACHINERY.

AMATEUR PHOTOGRAPHIC APPARATUS.
Latest invention. Everybody can operate with
perfect success. Complete with chemicals from
\$5 to \$25. Enclose stamp for circulars.
E. SACKMANN & CO., 600 DeKalb Ave.,
Brooklyn, N. Y.

**WESSELL METAL. A PERFECT IMITA-
TION** of gold in color, surface, and acid tests, for manu-
facturers of imitation jewelry, and other workers in fine
yellow metal. Weszell Metal Co., No. 317 E. 23d St., N. Y.

WIRE-DRAWING MACHINERY, SAW-MILLS,
Planers, etc., made by
S. HEALD & SONS, Barre, Mass.

FLOWERS
Strong Plants delivered free of cost safely
per mail at your door. Satisfac-
tion guaranteed. Splen-
did assortment of
ROSES
6 for \$1.
12 for \$2. Send for
New Catalogue of Plants.
HOOPES, BIRD & THOMAS,
Cherry Hill, Nurseries, West Chester, Pa.

SALESMEN wanted to solicit orders for our
goods. Permanent employment
on salary or commission. Add.
Union Industrial Works, Cincinnati, O.

IMPORTANT FOR ALL CORPORATIONS AND
MANUFACTURERS.—Buerk's Watch-
man's Time Detector, capable of accurately con-
trolling the motion of a watchman or patrolman at the
different stations of his beat. Send for circular.
J. E. BUERK, P.O. Box 979, Boston, Mass.
N. B.—The suit against Imhaeuser & Co., of New York,
was decided in my favor, June 10, 1874. Proceedings
have been commenced against Imhaeuser & Co. for sell-
ing, contrary to the order of the Court. Persons using
clocks infringing on my patent, will be dealt with
according to law.

SPECIAL MACHINERY, TOOLS, MODELS, AND
Patented Articles made to order by **A. A. POOL & CO.,**
55 R. R. Ave., Market St. Station, Newark, N. J.

WROUGHT
IRON
BEAMS & GIRDERS

THE UNION IRON MILLS, Pittsburgh, Pa., Manu-
facturers of improved wrought iron Beams and
Girders (patented).
The great fall which has taken place in the prices of
iron, and especially in Beams used in the construction
of FIRE PROOF BUILDINGS, induces us to call the special
attention of Engineers, Architects, and Builders to the
undoubted advantages of now erecting Fire Proof
structures; and by reference to pages 32 & 34 of our Book
of Sections—which will be sent on application to those
contemplating the erection of fire proof buildings—THE
COST CAN BE ACCURATELY CALCULATED, the
cost of Insurance avoided, and the serious losses and in-
terruption to business caused by fire; these and like con-
siderations fully justify any additional first cost. It is
believed, that were owners fully aware of the small
difference which now exists between the use of Wood
and Iron, that in many cases the latter would be adopted.
We shall be pleased to furnish estimates for all the Beams
complete, for any specific structure, so that the difference
in cost may at once be ascertained. Address
CARNEGIE, BROS. & CO., Pittsburgh, Pa.

HYATT
& CO'S
VARNISHES
246 GRAND ST.
N. Y. CITY

Send for Circular and Descriptive
Price List.

Wood-Working Machinery,
Such as Woodworth Planing, Tongueing, and Grooving
Machines, Daniel's Planers, Richardson's Patent Im-
proved Tenon Machines, Mortising, Moulding, and
Re-Saw Machines, and Wood-Working Machinery gener-
ally. Manufactured by
WITHERY, RUGG & RICHARDSON,
25 Salisbury Street, Worcester, Mass.
(Shop formerly occupied by R. BALL & CO.)

SALESMEN AND AGENTS WANTED TO SELL
valuable Patents. **GEO. WOOD, Lovells, Erie Co., Pa.**

Pocket Coin Detector.
—Size of a silver dollar; it tests size, gauge,
and weight. U. S. Mint standard; price 25c.
by mail; agents wanted; liberal discounts.
J. W. SUTTON, 95 Liberty St., New York.

WE ENAMEL
in FINE JET BLACK every variety of turned woodwork
parts of machinery, castings, ironware and other metal
work ENAMELED JET BLACK, in wood or metal, made to order
AMERICAN ENAMEL CO. 17 WARE'S ST. PROVIDENCE, R. I.

BROCK'S PATENT COMBINED
Pepper Box and Salt-Cellar, for Dining Rooms, Restau-
rants, sportsmen, Travelers, Laborers, Scholars, and all
persons carrying lunch. Sent by mail for 25c.; 5 for \$1.
Address **O. M. BROCK, Monroeton, Bradford Co., Pa.**

A NEW DEPARTURE. TRAVELING
Sally, 21st St. and 1st Ave. N. Y. City. NO PEDDLING
Salary \$25 a month. Hotel and traveling expenses paid.
S. A. GRANT & CO., manufacturers of ENVELOPES
and PAPER, 2, 4, and 6 Home St., Cincinnati, Ohio.

P. BLAISDELL & CO.,
Worcester, Mass.,
Manufacturers of the Blaisdell Patent Upright Drills
and other first-class Machinists' Tools.

Boul's Patent
Reverse Motion
Planing, Variety
Moulding and
Dovetailing
Machine.
cuts Panels of
any design or
style of mould in
the solid wood
with neatness and
dispatch, is a
first class
Shaper, Edge
and Scroll
Moulder.
Does general
dovetailing with
thick or thin
stuffs.

Simple, Durable and Efficient.
Send for Pamphlet and
Sample of work.
Improved Solid Steel Cutters for
all kinds of Variety Moulders
made to order, and warranted
by the
H. C. MACHINERY CO.
BATTLE CREEK, MICH.

Revolvers
7-shot \$2.50, 70 kinds. Guns & Rifles \$5
to \$500. Monster 11. Cat. for 5-ct. stamp.
WESTERN GUN WORKS, Chicago, Ill.

VANDERBURGH, WELLS & CO., MACHINISTS
Patterns and Brand Letters, etc., Complete
Newspaper Outfits, Engravers' Boxes, etc.
15 Dutch Street, Cor. Fulton, New York.

\$66 a Week in your own town. Terms and \$5 outfit
free. **H. HALLITT & CO., Portland Maine.**

PERFUMERY. — BY W. SAUNDERS,
Pharmacist.—A valuable and practical paper upon the
preparation of Perfume Extracts. With Formulae for
the preparation of the most prominent and popular Per-
fumes now on the market, directions for the preparation
and compounding of the ingredients, etc. The Formulae
here given embrace the preparation of the following
Perfumes:—Jockey Club, Moss Rose, White Rose,
Victoria, Ess. Bouquet, Musk, Patchouly, Millefleur,
Ylang Ylang, Spring Flowers, Wood Violet, West End,
Tuberose, Stephanotis, Rondeletia, New Mown Hay,
Frangipanni, Clove Pink, Violet, Mignonette. Contained
in SCIENTIFIC AMERICAN SUPPLEMENT No. 65.
Price 10 cents. To be had at this Office, and of all News-
dealers.

N. Y. STENCIL WORKS, 87 Nassau St., N. Y.

Steel Name Stamps.

OPIUM and Morphine habit cured pain-
less: No Publicity. Dr. CARLTON
187 Washington St., Chicago, Ill.

GLASS OILERS. Best in use. Send for circular.
CODY & RUTHVEN, Cincinnati.

PATENT SCROLL AND BAND SAW MACHINES A
specialty. **CORDEMAN, EGAN & CO., Cincinnati, O.**

STUDIES OF MATTER AND LIFE.—By
Prof. Henry J. Slack, F.R.S. A most interesting and
valuable paper, explaining the latest scientific theories,
researches and calculations, concerning the various
Modes of Motion, the Ether of Space, the Transmission
of Wave Forces, the Limit of Vision, the Size of Atoms,
Motion and Force of Atoms, Grouping of Atoms. Phen-
omena of Reproduction, Mental Phenomena. SCIENTIFIC
AMERICAN SUPPLEMENT No. 47. Price, 10 cents.
To be had at this office and of all newsdealers.

Small Tools of all kinds; also GEAR WHEELS, parts
of MODELS, and materials of all kinds. Castings of
Small Lathes, Engines, Slide Rests, etc. Catalogues free.
GOODNOW & WIGHTMAN, 25 Cornhill, Boston, Mass.

IT PAYS to sell our Rubber Hand Printing Stamps.
Terms free. **G. A. HARPER & BRO., Cleveland, O.**

\$50. 10 SCREW-CUTTING FOOT LATHES.
Foot Drill Presses. Send for Circular to
H. L. SHEPARD, Cincinnati, O.

HOME TELEGRAPH INSTRUMENT.
Battery, Book of Instructions. Complete and reliable
outfit for Learning Telegraphy, and operating private
Telegraph Lines. Price \$3.00. Descriptive circulars
mailed free. **L. G. TILLOTSON & CO., 8 Day St., N. Y.**

BIG PAY to sell our RUBBER PRINTING STAMPS.
Terms free. **TAYLOR & CO., Cleveland, O.**

TURBINE WATER WHEELS.—A RE-
PORT of the official Tests of Turbine Water Wheels
made during the Centennial Exhibition of 1876. With
thirty-one illustrations. Embracing Drawings and De-
scriptions of the Apparatus used for each test. The
Instruments employed for determining the Power and
revolutions of each wheel. Engravings and descriptions
showing the Construction of the wheels that exhibited
the Greatest Efficiency. Table showing the Names of
the Exhibitors of the several wheels tested. Date of
each test. Diameter of wheel. Fraction of gate.
Weight on the scale in pounds. Revolutions per minute.
Horse-power of wheel. Head on wheel, in feet. Head
on weir, in feet. Flow over weir. Head on weir due to
leakage. Horse-power of the water used. Percentage
of efficiency realized by each wheel. Together with
other valuable and interesting particulars. Contained
in SCIENTIFIC AMERICAN SUPPLEMENTS Nos. 50 and 61.
10 cts. each. To be had at this office and of all news-
dealers.

BAKER'S
Rotary Pressure Blower

FORCED **BLAST!**
Warranted superior to any other.
WILBRAHAM BROS.
No. 2318 Frankford Avenue, Philadelphia.

Pond's Tools
Engine Lathes, Planers, Drills, &c.
Send for Catalogue. **DAVID W. POND, Successor to**
LUCIUS W. POND, Worcester, Mass.

STEAM PUMPS.
FIRST PRIZES, CENTENNIAL, PHILA., VIENNA,
PARIS, NEW YORK, BALTIMORE, BOSTON.
Send for circular of recent patented improvements.
THE NORWALK IRON WORKS CO.,
South Norwalk, Conn.
Prices Reduced.

NONPAREIL
FARM & FEED MILLS.
Best Drive and Horse Mills. 10 sizes
for Hand or Power. Conical French
Barry Bone Flouring and Corn Mills.
7 1/2" Were awarded highest Medal and
Diploma at Centennial Exposition.
Illustrated Pamphlet sent Free
Address: **L. J. MILLER,**
161 E. Front St., Cincinnati, O.

Brainard Milling Machines all styles
Universal Milling Machines from \$300 upwards. Brainard's
Patent Screw Machines, &c., &c. Address **BRAINARD**
M. M. CO., 131 MILK ST., Boston, Mass.

GEORGE C. HICKS & CO.,
Baltimore, Md.
CLAY RETORTS, TILES, FIRE BRICKS, &c.
17 Terra Cotta Pipes of all sizes.

U.S.
YOU ask WHY we can sell First-
Class T-1-3 Octave Banjo-Pianos
for \$299. Our answer is, that it costs
less than \$300 to make any \$400 Piano
and through Agents all of whom
make 100 per cent. profit. We have a
Agency, but still direct to Family
We send our Pianos everywhere for trial
and require no payment unless they are
sent satisfactory. Send for our Illustrated Circular, which gives
full particulars, and contains the names of over 100 Bankers, Mer-
chants and Families that are using our Pianos in every State of the
Union. Please state where you saw this notice. Address,
U. S. PIANO CO., 810 Broadway, N. Y.

The SCIENTIFIC AMERICAN is devoted to the in-
terests of Popular Science, the Mechanic Arts, Manu-
factures, Inventions, Agriculture, Commerce, and the
industrial pursuits generally; and it is valuable and in-
structive not only in the Workshop and Manufactory,
but also in the Household, the Library, and the Reading
Room. Each volume contains hundreds of Notes,
Receipts, and Suggestions and Advice, by Practical
Writers for Working Men and Employers, in all the
various arts.

AYER & SON'S MANUAL
For Advertisers
A complete guide to advertisers. New Haven Journal.—
A necessity to all who advertise. Louisville Commercial.—
The most complete and reliable work of the kind.
Pittsburg Gazette.—Sent free to all who advertise.
N. W. AYER & SONS, 1 PHILADELPHIA.
Get our Estimate before making any advertising
contracts. Our business is large. Facilities must
pass. Prices the lowest. Terms the best.

\$12 a day at home. Agents wanted. Outfit and
terms free. **TRUE & CO., Augusta, Maine.**

Lathes, Planers, Shapers, Drills,
Gear & Bolt Cutters, &c. E. GOULD, Newark, N.J.

**SEE PHOTOGRAPHIC APPA-
RATUS & CHEMICALS**
complete, with directions, \$10. No toy; takes pictures
2 1/2 inches. Send for circular.
B. MORGAN, 425 Monmouth St., Jersey City, N. J.

\$2500 a year to Agents. Outfit and a
\$25 Shot Gun free. For terms ad-
dress, **J. Worth & Co., St. Louis, Mo.**

\$55 & \$77 a week to Agents. \$10 Outfit Free.
P. O. VICKERY, Augusta, Maine.

SPARE THE CROTON AND SAVE THE COST.
Driven or Tube Wells

furnished to large consumers of Croton and Ridgewood
Water. **WM. D. ANDREWS & BRO., 44 Water St., N. Y.**
who control the patent for Green's American Driven Well

The Toll-Gate! Prize Picture sent free!
An ingenious gem! 50 objects
to find! Address, with stamp, **E. C. ASBEY, Buffalo, N. Y.**

\$984 Made by one Agent in 37 days. 13 new
articles. Samples free. Address,
C. M. LININGTON, Chicago.

\$5 TO \$10 A DAY TO AGENTS. SAMPLES FREE. 32
page catalogue. **L. FLETCHER, 11 Day St., N. Y.**

\$5 Outfit free. Salary guaranteed. Write at once to
EMPIRE NOVELTY CO., 30 Broadway, New York.

WANTED MEN to travel and sell to Dealers our unbreak-
able glass chimneys and lamp goods. NO
Salary. Travel, Board and traveling expenses
paid. **MONITOR LAMP CO., 264 Main St., Cincinnati, Ohio.**

\$3 WATCHES. Cheapest in the world.
Samples sent and outfit free to Agents.
For terms address **COUTLER & CO., Chicago.**

ON THE PROGRESS OF AERONAUTICS.
An essay read before the Aeronautical Society of Great
Britain. By Frederick W. Brearey, Secretary of the
Association. A useful and interesting paper. Containing
brief accounts of the most recent trials of balloons hav-
ing mechanical propelling attachments. The required
dimensions and best forms for balloons with propelling
machinery. Calculations of the power exerted by birds
in travelling through the air, and their methods of ac-
tion. Calculations of the mechanical requisites for suc-
cessful aerial navigation, as indicated by the flight of
birds. Report of balloon trials having vertical screw
propellers, made by the British War Office. Air naviga-
tion by "pushing" balloons. Experimental trials of the
Society's apparatus for testing the Lifting Power of
plane surfaces when exposed to wind currents. Descrip-
tion and dimensions of Moys' steam Aerial Locomotive,
with an account of its practical trial at the Crystal Palace.
Description of Moys' remarkable self lifting steam en-
gine and boiler, of one horse power, but weighing only
thirteen pounds, with dimensions, arrangement of the
lifting fans, etc. Contained in SCIENTIFIC AMERICAN
SUPPLEMENT No. 50. Price 10 cents. To be had at this
office and of News Dealers.

A MILL WITH WATER POWER TO LET, BETWEEN
Midland Park and Ridgewood Stations, near Paterson,
N. J. For particulars, apply to **DAVID BALDWIN,**
Midland Park, N. J.

BRADFORD MILL CO.
Successors to J. A. Bradford & Co.
MANUFACTURERS OF
French Burr Millstones,
Portable Corn & Flour Mills,
Smut Machines, etc.
Also, dealers in Boiling Cloths and
General Mill Furnishings.
Office & Factory, 158 W. 2d St.
CINCINNATI, O.
J. R. Stewart, Pres. W. E. Dunlap, Sec.
C/PRICE-LISTS SENT ON APPLICATION.

Blake's Patent Stone & Ore Crusher.

NEW PATTERNS, with important im-
provements, and abundant
strength. This is the only machine used
by the principal MUNICIPAL, RAILROAD
and MINING CORPORATIONS and CON-
TRACTORS in the United States and
foreign countries, for breaking hard and
brittle substances to ANY SIZE. Send
for circular. Address
BLAKE CRUSHER CO., New Haven, Ct.

Advertisements.

Inside Page, each insertion --- 75 cents a line.
Back Page, each insertion --- \$1.00 a line.
Engravings may be inserted at the same rate per line, by measurement, as the letter press. Advertisements must be received at publication office as early as Friday morning to appear in next issue.

RUBBER
Belting, Packing, Hose, Clothing, Boots and Shoes, etc.
Send for Price List. MACDONALD & SUTTON,
220 Broadway, New York.

GUARDIOLA'S
COFFEE & SUGAR MACHINERY
Coffee, Malt, Corn, Cocoa, and Grain-Drying Machine, Coffee-Hulling and Polishing Machines, Coffee-Washing Machine, Helix Sugar Evaporator.
Messrs. C. ADOLPHE LOW & CO., 42 Cedar Street, Messrs. MUNOZ & ESPRIELLA, 52 Pine Street, New York, are Mr. Guardiola's Agents, and they will give prompt attention to all orders for any of the above machines.

Best Tempered Cast Steel.
Retail Price, 9 Cents per lb.
WARRANTED. Send for Circular.
Fisher & Norris, Trenton, N. J.

THE SUCCESS.
The Bollinger Water Wheel, so favorably known, has been purchased and improved, and will hereafter be built and sold by me under the name THE SUCCESS. Not only a premium, but the first premium, was awarded to this wheel, as now improved, at the Centennial. Send for descriptive pamphlet to S. M. SMITH, York, Pa.

Incombustible Mineral Wool
The best and cheapest insulator of heat or cold. Send for circulars, 264 Broadway, New York.
ALEXANDER D. EILERS,
P. O. Box 4651, Agent for the Patentee.

MACHINISTS' TOOLS.
NEW AND IMPROVED PATTERNS.
Send for new illustrated catalogue.
Lathes, Planers, Drills, &c.
NEW HAVEN MANUFACTURING CO.,
New Haven, Conn.

PATENTS
[ESTABLISHED 1846.]

Munn & Co's Patent Offices.
The Oldest Agency for soliciting Patents in the United States.
THIRTY YEARS' EXPERIENCE.

MORE PATENTS have been secured through this agency, at home and abroad, than through any other in the world.

They employ as their assistants a corps of the most experienced men as examiners, specification writers, and draughtsmen, that can be found, many of whom have been selected from the ranks of the Patent Office.

SIXTY THOUSAND inventors have availed themselves of Munn & Co's services in examining their inventions and procuring their patents.

MUNN & CO., in connection with the publication of the SCIENTIFIC AMERICAN, continue to examine inventions, confer with inventors, prepare drawings, specifications, and assignments, attend to filing applications in the Patent Office, paying the Government fees, and watch each case, step by step, while pending before the examiner. This is done through their branch office, corner F and 7th Sts., Washington. They also prepare and file caveats, procure design patents, trade marks, and reissues, attend to rejected cases (prepared by the inventor or other attorneys), procure copyrights, attend to interferences, give written opinions on matters of infringement, furnish copies of patents, and, in fact, attend to every branch of patent business, both in this and in foreign countries.

A special notice is made in the SCIENTIFIC AMERICAN of all inventions patented through this agency, with the name and residence of the patentee. Patents are often sold, in part or whole, to persons attracted to the invention by such notice.

Patents obtained in Canada, England, France, Belgium, Germany, Russia, Prussia, Spain, Portugal, the British Colonies, and all other countries where patents are granted, at prices greatly reduced from former rates. Send for pamphlet pertaining specially to foreign patents, which states the cost, time granted, and the requirements for each country.

Copies of Patents.

Persons desiring any patent issued from 1836 to November 26, 1867, can be supplied with official copies at reasonable cost, the price depending upon the extent of drawings and length of specifications.

Any patent issued since November 27, 1867, at which time the Patent Office commenced printing the drawings and specifications, may be had by remitting to this office \$1.

A copy of the claims of any patent issued since 1836 will be furnished for \$1.

When ordering copies, please to remit for the same as above, and state name of patentee, title of invention, and date of patent.

A pamphlet, containing full directions for obtaining United States patents, sent free. A handsomely bound Reference Book, gilt edges, contains 160 pages and many engravings and tables important to every patentee and mechanic, and is a useful handbook of reference for everybody. Price 25 cents, mailed free.

Address
MUNN & CO.,
Publishers SCIENTIFIC AMERICAN,
37 Park Row, N. Y.

BRANCH OFFICE—Corner of F and 7th Streets,
Washington, D. C.

Before purchasing Paints or Roofing, send for Samples and
REDUCED Price List of

H.W. JOHNS' PATENT ASBESTOS MATERIALS

ROOFING, with White Fire-Proof Coating. The handsomest, coolest, most durable, and only reliable portable Roofing made. Easily applied by any one. Costs only half as much as tin.

PAINTS—Twelve newest shades, ready for use. Guaranteed in every respect equal to the best produced in this country, and more durable than any others for outside work.

STEAM PIPE AND BOILER COVERINGS—The most effective and economical appliances known.

STEAM PACKING—Self-lubricating, indestructible. Loose and Round, all sizes. ASBESTOS BOARD.

ROOF PAINT—FIRE-PROOF PAINTS, FIRE, ACID, AND WATER-PROOF CEMENTS, FELTS, ETC.

All these materials are prepared for use in neat and compact form, are suitable for all climates, and can be easily applied by any one. Liberal inducements to General Merchants, Dealers, and Large Consumers.

SEND FOR SAMPLES, ILLUSTRATED CATALOGUES, PRICE LISTS, ETC.

H. W. JOHNS MANUFACTURING CO.,
87 Maiden Lane, New York.

Also for sale by PHILADELPHIA BRANCH, 406 Arch st.; DOWNE, TRAINER & CO., Boston; S. W. HEMPTSTED & CO., Columbus, O.; T. S. & A. J. KIRKWOOD, Chicago; M. M. BUCK & CO., St. Louis; H. D. COLEMAN & BRO., New Orleans; THOMPSON & UPSON, San Francisco.

CAUTION.—The public are cautioned against purchasing or using any materials for the above or similar purposes purporting to contain ASBESTOS, unless they bear our name and dates of patents.

NOYE'S MILL FURNISHING WORKS
are the largest in the United States. They make Burr Millstones, Portable Mills, Smut Machines, Packers, Mill Picks, Water Wheels, Pulleys and Gearing, specially adapted to flour mills. Send for Catalogue.
J. T. NOYE & SON, Buffalo, N. Y.

ESTABLISHED 1841.
JOSEPH C. TODD,
(Formerly of Todd & Rafferty), ENGINEER and MACHINIST. Flax, Hemp, Jute, Rope, Oakum, and Bagging Machinery, Steam Engines, Boilers, etc. Also Agent for the celebrated and improved Rawson & Rittinger Hoisting Engine. I will furnish specifications and estimates for all kinds of machinery. Send for descriptive circular and price. Address
J. C. TODD,
10 Barclay St., New York, or Paterson, N. J.

JOS. G. ROGERS & CO., MADISON, IND.,
wish to place a consignment of their Tannate of Soda BOILER SCALE PREVENTIVE in all important towns in the United States, to be sold on commission. Applications solicited. Send for book on Boiler Incrustation.

NON-COMBUSTIBLE STEAM BOILER AND PIPE COVERING
WITH "AIR SPACE" IMPROVEMENT.
Saves 10 to 20 per cent. CHALMERS SPENCE CO.,
Foot E. 9th St. N. Y.; 1322 N. 3d St., St. Louis, Mo.

Machines AND Wheels
Guaranteed.
LEHIGH VALLEY EMERY WHEEL CO.
Send for Illustrated Circular.
Weissport, PA.

HARTFORD STEAM BOILER Inspection & Insurance COMPANY.
W. B. FRANKLIN, V. Pres't. J. M. ALLEN, Pres't.
I. B. PIERCE, Sec'y.

\$5 to \$20 per day at home. Samples worth \$5 free. STINSON & CO., Portland, Me.

STEAM PUMPS
Wright's Pat. Bucket Plungers are the best. VALLEY MACHINE CO., Easthampton, Mass.

THE BEST AND MOST ECONOMICAL

Boiler Feeder

FRIEDMANN'S INJECTOR,

MANUFACTURED BY
NATHAN & DREYFUS, New York.
108 Liberty St.

Send for Circular.

STEAM ENGINES

Clipper Vertical Engines, off and on Wheels.
Price, on wheels, 6-horse power, \$450; 8-horse, on wheels, price \$700. Dry Steam Horizontal Engines, 8-Horse Power Climax, on wheels, \$500. Builders of Stationary Engines, 4 styles, from 6 to 20-horse power. Corlies Engines, Extra Finish and Cut-off Engines. Crank Stationary and Plain Finished Engines, Boilers, Circular Saw Mills, etc.
Successors to Union Steam Engine Co., formerly Wood & Mann. Established 1857.
We have the largest line Engine Patterns in United States. Good, responsible Agents wanted.
TAYLOR MANUFACTURING CO.,
Westminster, Maryland.

YALE IRON WORKS,
New Haven, Conn.,
Builders of the YALE VERTICAL, the best and most economical, either for land or marine use; also HORIZONTALS, with or without the Rider Cut-off.
SPECIAL TOOLS made to order, all at prices that defy competition. Send for Circular.

Niagara Steam Pump Works.
ESTABLISHED 1836.
CHARLES B. HARDICK,
No. 23 Adams Street,
BROOKLYN, N. Y.

KNOWLES' STEAM PUMP WORKS,
92 & 94 Liberty St., New York.
Great reduction in prices. Send for catalogue. The "Knowles" has always been the best steam pump made.

ROCK DRILLING MACHINES AND AIR COMPRESSORS
MANUFACTURED BY BURLEIGH ROCK DRILL CO.
SEND FOR PAMPHLET. FITCHBURG, MASS.

Type and Printing Materials FOR SALE.

The following Fonts of Type, in good condition, having been but little used:
Brevier, on Long Primer Body, about 500 lbs.
Brevier, 100 lbs.
Nonpareil, on Brevier Body, 300 lbs.
Agate, 250 lbs.
Sixteen Cases Job Type, in Cabinet.
All the above are Copper-faced.
Leads, Brass Rules, etc.
Cases, 44 pairs.
Column Gallies, brass bottomed, 6.
Chases, wrought iron, 2 pairs, 36x24 inches.
Composing Frames, 4.
Racks, 2.
Imposing Stones, one 75x30 inches, one 72x30, both on stands with drawers.
Roller Press.
The above were used on the SCIENTIFIC AMERICAN, and are in clean and perfect condition. The room in which the above is deposited is wanted for other purposes on the first of May, and the lot will be sold very cheap. Apply at the office SCIENTIFIC AMERICAN, 37 Park Row, N. Y., for further particulars.

FOR SALE, TO CLOSE THE CONCERN.

Entire contents of Machine Shop, No. 279 Cherry Street, New York city, consisting of 30 h. Steam Boiler, now in good running order, 12 h. p. Steam Engine, Cameron Steam Pump, Planing Machine, Engine Lathes, Milling Machines, Screw Cutters, Ordinary Lathes, Shears, Presses, Small Blower, Forge, Vises, Variety of Small Tools, Shafting, Pulleys, Belting, Benches, Patterns, etc. Will be sold in lots to suit purchasers, at very low prices. Apply immediately to E. D. BARLOW, Assignee, as above. Lease of premises—50x30 ft.—for sale.

EAGLE FOOT LATHES,
With Scroll and Circular Saw Attachments, Slide Rest, Tools, &c.; also Small Engine Lathes, Metal Hand Planers, &c. Neatest designs, superior finish. Low prices. Our new Catalogue describes these and every tool necessary for the Amateur or Artisan. Send for it.
WM. L. HULSE & CO.,
95 & 97 Liberty St., New York.

PATENT COLD ROLLED SHAFTING.

The fact that this shafting has 70 per cent. greater strength, a finer finish, and is truer to gauge, than any other in use, renders it undoubtedly the most economical. We are also the sole manufacturers of the CELEBRATED COLLINS' PAT. COUPLING, and furnish Pulleys, Hangers, etc., of the most approved styles. Price list mailed on application to
JONES & LAUGHLIN,
Try Street, 2d and 3rd Avenues, Pittsburgh, Pa.
100 S. Canal Street, Chicago, Ill., and Milwaukee, Wis.
Stocks of this shafting in store and for sale by
FULLER, DANA, & FLETCHER, Boston, Mass.
GEO. PLACE & CO., 121 Chambers St., N. Y.

MACHINERY OF IMPROVED STYLES FOR making SHINGLES, HEADING AND STAVING; also GUAGE LATHES for TURNING HANDLES. Sole makers of Law's Pat. Shingle and Heading Staving Machine. Address
TREVOR & CO., Lockport, N. Y.

\$3 PRINTING PRESS!
Prints cards, envelopes, etc., equal to any press. Larger sizes for large work. Do your own printing and advertising and save money. Excellent spare hour amusement for old or young. Or it can be made money making business anywhere. Send 3c. stamps for large catalogue to
KELSEY & CO., Meriden, Conn.

WOOD & LIGHT Machine Co.
WORCESTER, MASS.
Manufacture all kinds of Iron-Working Machinery, including many novelties. Shafting, Pulleys, &c.
Send for Circular.

PUNCHING PRESSES.
Drop Hammers and Dies, for working Metals, &c. TIE STILES & PARKER PRESS CO., Middletown, Conn.

THE TANITE CO.,
STROUDSBURG, PA.
EMERY WHEELS AND GRINDERS.
GEO. PLACE, 121 Chambers St., New York Agent.

BUY YOUR BOILER AND PIPE COVERING

direct from the Manufacturers.
ASBESTOS FELTING CO.,
Front St., near Gouverneur, N. Y.

PATENT FOR SALE.—A NEW AND VALUABLE PATENT OF A STEAM TRAP.
Address T. MERKLEY, South Brooklyn, N. Y.

Pyrometers,
For showing heat of Ovens, Hot Blast Pipes, Boiler Flues, Super-Heated Steam, Oil Stills, &c.
HENRY W. BULKLEY, Sole Manufacturer,
149 Broadway, New York.

The HOADLEY PORTABLE STEAM ENGINE,
WITH AUTOMATIC CUT-OFF REGULATOR AND BALANCED VALVE.
THE BEST & MOST ECONOMICAL ENGINE MADE.
SEND FOR CIRCULAR.
The J. C. HOADLEY CO., LAWRENCE, MASS.
STATE WHERE YOU SAW THIS.

A. S. CAMERON'S PATENT "SPECIAL" Steam Pump
Is the Standard of Excellence at home and abroad.
REDUCED PRICE LIST.

Number.	PRICE.	Steam Cyl.	Pump Cyl.	Stroke.
0	\$ 50	3 1/2 in.	2 in.	4
1	75	4	2 1/2	6
2	100	5	3	6
3	150	6	3 1/2	7
4	200	7	4	7
5	275	8	4 1/2	10
6	325	8	5	10
7	400	10	5 1/2	12
8	425	10	6	12
9	450	12	7	12
10	550	14	9	15
11	700	16	10 1/2	15
12	850	18	12	18

Illustrated Catalogue sent free, on application to the Inventor and Sole Manufacturer in the United States.

A. S. CAMERON,
Works, Foot of East 23d St.
NEW YORK CITY.

The New \$20 Microscope

is fully equal to any that could have been bought three years ago for \$50. Send for descriptive circular.

For the best book of practical instruction get "How to Use the Microscope," by John Philin. 75 cts. by mail.

INDUSTRIAL PUBLICATION CO., 176 Broadway, N. Y.

FOR ALL KINDS OF MACHINERY—Apply to
S. C. HILLS, 78 Chambers St., New York.

A MANUFACTURING ESTABLISHMENT, located on the line of the Pennsylvania Railroad, 120 miles from this city, and making goods in universal demand in this country, and with a trade established in Germany on the increase. The profits of the business are large, using water-power nine months in the year. One of the two partners will retire in a short time, and the one remaining wishes a man of business to succeed him as PARTNER. The capital required is \$10,000 to \$15,000. The condition and extent of the business can readily be shown. Only principles will be noticed. Address MORGAN & CO., 154 S. 4th St., Phila., Pa.

1872, 1873, 1874, 1875, 1876, SCIENCE RECORD.

A few copies of these splendid books, copiously illustrated, are offered at the following very low prices. Persons desiring a condensed history of the most interesting Facts and Discoveries in the Arts, Sciences, and Inventions, for the years from 1872 to 1876, will find them recorded in the five volumes of the SCIENCE RECORD, now offered at half the original price.

Every Department of Science is treated in these volumes, and the important discoveries of the several years are not only faithfully described, but many of the subjects are illustrated with finely executed engravings, prepared expressly for these Annuals.

Among the subjects, the following are the most noteworthy, exhibiting in a condensed form a general account of the Progress of the World:
CHEMISTRY AND METALLURGY,
MECHANICS AND ENGINEERING,
ELECTRICITY, LIGHT, HEAT, SOUND,
TECHNOLOGY, THE USEFUL ARTS,
BOTANY AND HORTICULTURE,
AGRICULTURE,
RURAL AND HOUSEHOLD ECONOMY,
MATHEMATICS, THEORETICAL, HYGIENE,
NATURAL HISTORY AND ZOOLOGY,
METEOROLOGY, TERRESTRIAL PHYSICS,
GEOGRAPHY,
GEOLOGY AND MINERALOGY,
ASTRONOMY,
PHYSIOLOGY AND NECROLOGY.

Each yearly volume contains about 600 octavo pages, including a large number of handsome engravings. They are bound in substantial and handsome bindings, and will be mailed on receipt of \$1.25 each, or \$5 for the set of five volumes.

They were published and heretofore sold at \$2.50 each, or \$10 for the set.

State, in remitting for a single volume, which year, from 1872 to 1876, is desired, remembering that the date of the volume covers the events and discoveries of the previous year. Sent by mail on receipt of price. Address
MUNN & CO., Publishers,
37 Park Row, New York city.

PIONEER IRON WORKS,

Nos. 149 to 163 William St., BROOKLYN, N. Y.
Manufacturers of the A. LINCOLN Patent Steam ROAD ROLLER and TRACTION Engine and Tractor. Also all kinds of Paving Machinery. Machinery for Sugar Houses and Plantations a Specialty.

Alexander Bess's Patent Portable Iron Railroad.

THE "Scientific American" is printed with CHAS. ENEU JOHNSON & CO.'S INK. Tenth and Lombard Sts., Philadelphia, and 59 Gold St., New York.

SCIENTIFIC AMERICAN

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. XXXVI.—No. 18.
[NEW SERIES.]

NEW YORK, MAY 5, 1877.

[\$3.20 per Annum.
[POSTAGE PREPAID.]

IMPROVED BRICK MACHINE.

We illustrate herewith a new brick machine, in which the bricks are moulded in sockets made in the periphery of a cylinder which rotates beneath a pug mill. The construction of the apparatus is both strong and simple, while its action is as rapid as is consistent with the production of properly pressed bricks. A perspective view of the machine is shown in Fig. 1, and a section in Fig. 2.

A is the pug mill, in which the clay is ground and mixed. Beneath is a hollow cylinder, on the end of the shaft of which is a ratchet wheel, not shown in Fig. 1, being on the obscured side of the machine. The periphery of the cylinder is provided with a series of recesses or moulds, in each of which works an accurately fitting plunger. Each plunger has a stem, about which a spiral spring is coiled, and on the end of which is a roller. The clay having been received into the mould, from which the plunger is withdrawn by the action of its spring, the cylinder is then caused to rotate. Two levers, B, are secured, one at each end of the cylinder shaft, so as to have free motion thereon. The upper ends of these levers are connected to other levers, C, which, in turn, are attached to the wristpins of the crank wheels, D. Said crank wheels receive rotary motion from the pulley on the main driving shaft, E, by the belt shown.

The inner face of the lever, B, on the opposite side of the machine from that shown in Fig. 1, has a spring pawl, so arranged that it will engage with the ratchet wheel on the cylinder shaft, and rotate the same. Another pawl prevents any backward motion of said wheel. The levers, B, are connected by the arms, F, with a horizontal bar or press, G, and in their operation draw said bar against the clay in the series of moulds presented to it. The endless belt placed below the machine, for the reception of finished bricks, is prevented from sagging by passing over a series of small rollers, and is driven by a band from the main shaft.

The clay is delivered from the pug mill into the moulds while the cylinder is stationary, and, at the same instant, the press bar operates upon the clay in another set of moulds. The cylinder is then rotated, presenting another series of recesses to the mouth of the pug mill, as the press bar is drawn back. In the continued forward motion of the cylinder, and after the bricks in the moulds have been subjected to the action of the press bar described, the rollers on the end of the plunger stems upon the outer face of a fixed cam, H, Fig. 2, and force the bricks out of the moulds by throwing outward the plungers: so that, when the first mould filled has reached a point directly under its first position, the knife, I, Fig. 2, will pass between the brick and the face of the plunger and cause the brick to fall upon the endless belt.

For further information, address the patentees, Messrs. W. H. & H. P. L. Machen, Jr., Toledo, Ohio.

To Take Rust Out of Steel.

Place the article in a bowl containing kerosene oil, or wrap the steel up in a soft cloth well saturated with kerosene; let it remain 24 hours or longer; then scour the rusty spots with brickdust. If badly rusted, use salt wet with hot vinegar; after scouring, rinse every particle of brickdust or salt off with boiling hot water; dry thoroughly; then polish off with a clean flannel cloth and a little sweet oil.

Stopping the Wood Pores in Barrels.

The *Brewers' Gazette* gives the following: Put into an open vessel 1 lb. fine shreds of leather, 1 oz. oxalic acid, and 2 lbs. water. Suspend the vessel containing this mixture in one of larger size containing water, and boil until the contents of the inner vessel are dissolved by the action of the

Dyspepsia and Long Life.

A writer in the *New York Sun*, who has undoubtedly experienced the feeling produced by the disease, or he could not describe the effect so truthfully, says:

The dyspeptic, as a rule, is not numbered among the happiest of men; and there are good reasons why he should not be. He has an abiding notion that something is wrong somewhere in the universe, maybe everywhere; though, like the man who meets death suddenly, he often does not exactly know what hurts him. In some extreme cases he doesn't much care; only he would like to get rid of it, whatever it may be.

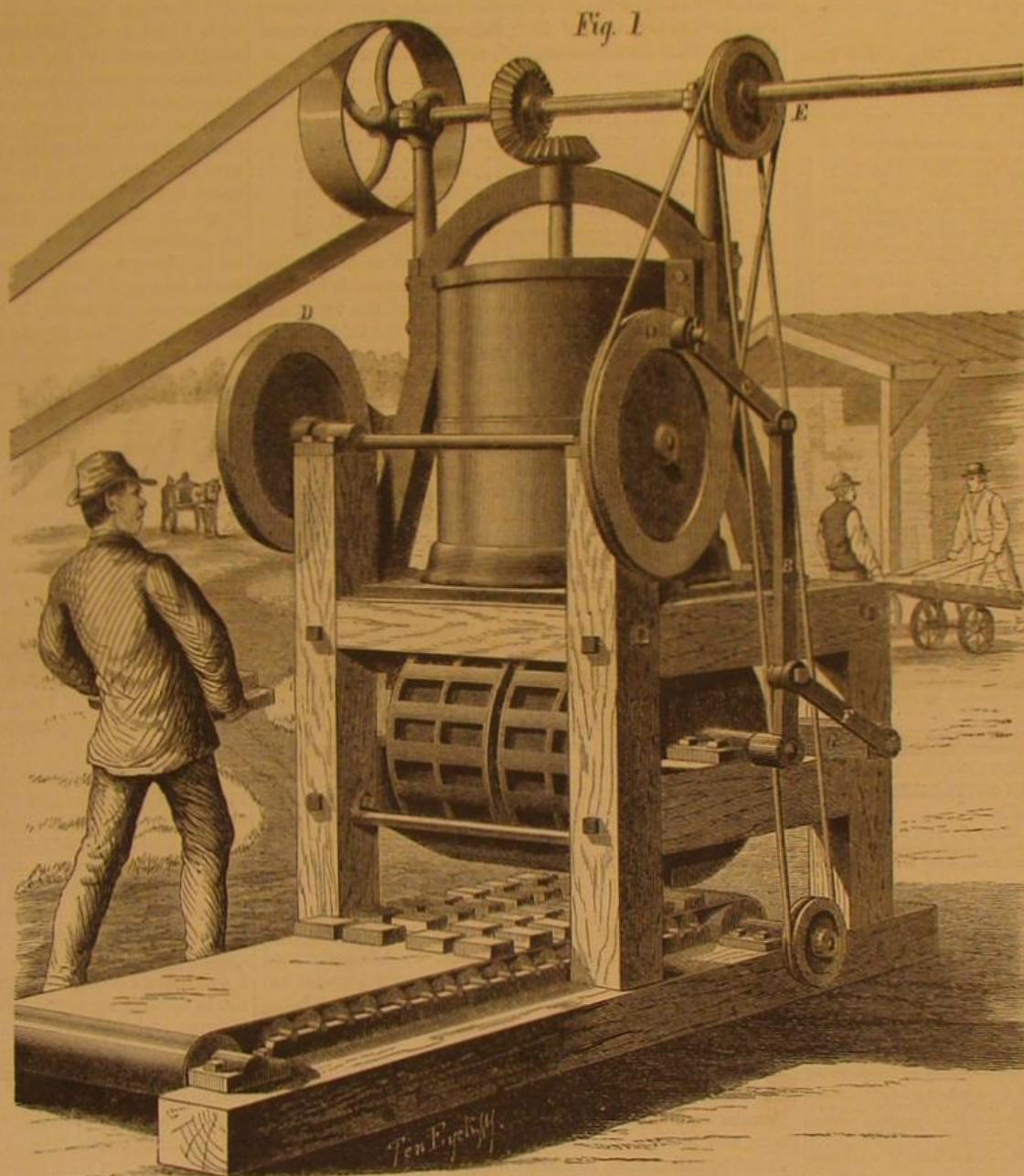
There is a well founded American tradition that pie baking and the frying pan have been fruitful sources of dyspeptic woes, though there are many victims of indigestion who have not fed upon pie crust or fried meats, while there are many people who have grown robust and ruddy on this diet, or in spite of it. Randolph, of Roanoke, who contributed to the philosophy of dyspepsia the cynical theory that though the Lord had given us the meats the devil had sent the cooks, only touched one part of the evil, for there are more sufferers from ill regulated digestion among luxurious people, who live upon the most nutritious and best cooked food, than among those whom exercise and labor give a hearty appetite for whatever they can get to eat.

The late Dr. W. W. Hall, formerly editor of the *Journal of Health*, has written very sensibly of this disorder in a little book just published in this city by R. Worthington. According to this writer, nine out of every ten cases of dyspepsia are caused not by any defect of the digestive organs, but by improper dieting and insufficient exercise, mental or physical. People, whom a disordered digestion requires to pay attention to these matters, frequently outlive by many years their more robust

neighbors. The author cites the case of one poor dyspeptic patient in whose case no less than sixty-three ailments were manifested: among them fretfulness, nightmare, and, most dismal of all, a sense of goneness. This was undoubtedly a very bad case, for, in spite of all that wealth could supply or careful treatment do to remove the disorder, it remained unabated, until finally the offending article of diet was discovered, and then recovery was rapid. In about a month's time the only trouble this restored dyspeptic had to complain of was that she could never get enough to eat. With this instance before his eyes, the most desperate dyspeptic may hope to live cheerfully to a ripe old age by searching out the cause of his troubles and resolutely applying himself to the removal of it.

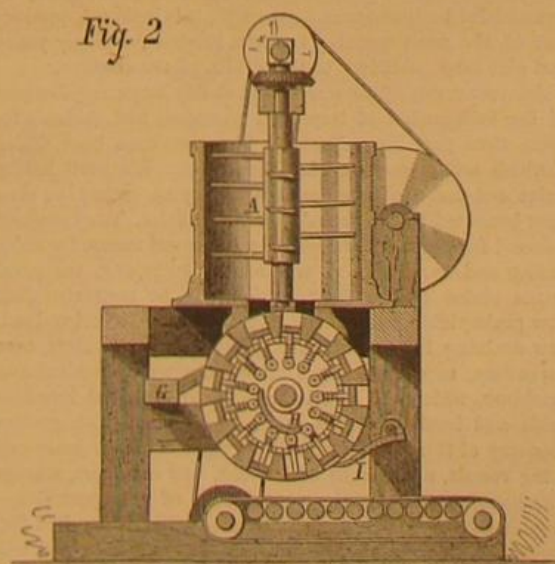
Dr. Hall recommends the sufferer to begin by eating little of one or two articles of food at regular meals. If that agrees with him let him increase the quantity; if not, he should try something else. In this way the dyspeptic will soon find out what agrees with him, and what kinds of food he should avoid. After he has made these discoveries, it will be his own fault if he continues a dyspeptic.

To CLEAN paint, take 1 oz. pulverized borax, 1 lb. small pieces best brown soap, and 3 quarts water; let simmer till the soap is dissolved, stirring frequently. Do not let it boil. Use with a piece of old flannel, and rinse off as soon as the paint is clean. This mixture is also good for washing clothes.



MACHEN'S ROTARY BRICK MACHINE.

Fig. 2



heat imparted from the boiling water (this is the water bath process). It must then be diluted with 3 lbs. of warm water. The mixture, when applied to the surface of wood, oxidizes and becomes insoluble, completely closing the pores of the wood. It is used for alcohol, and will neither crack nor peel off.

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT
NO. 37 PARK ROW, NEW YORK.

O. D. MUNN.

A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year, postage included..... \$3 20
One copy, six months, postage included..... 1 60

Clubs.—One extra copy of THE SCIENTIFIC AMERICAN will be supplied gratis for every club of five subscribers at \$3.20 each; additional copies at same proportionate rate. Postage prepaid.

The Scientific American Supplement

Is a distinct paper from THE SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly; every number contains 16 octavo pages, with handsome cover uniform in size with THE SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, \$3.50 a year, postage paid, to subscribers. Single copies 15 cents. Sold by all news dealers throughout the country.

Combined Rates.—THE SCIENTIFIC AMERICAN AND SUPPLEMENT will be sent for one year, postage free, on receipt of seven dollars. Both papers to one address or different addresses, as desired.

The safest way to remit is by draft, postal order, or registered letter.

Address MUNN & CO., 37 Park Row, N. Y.

Subscriptions received and single copies of either paper sold by all the news agents.

VOL. XXXVI, No. 18. [NEW SERIES.] Thirty-second Year.

NEW YORK, SATURDAY, MAY 5, 1877.

Contents.

(Illustrated articles are marked with an asterisk.)

Academy of Sciences, New York.....	281	Lenses, achromatic (25).....	276
Aerial propulsion.....	276	Locust eggs, experiments on.....	276
Aeronautics.....	276	Life preserver, a novel.....	274
America and war.....	272	Light, calcium (2).....	283
American competition.....	272	Light, calcium (2).....	283
American industry.....	281	Meat, American in England.....	279
Answers to correspondents.....	283	Mercury and gold amalgam (14).....	283
Astronomical notes.....	280	Micro-photographs, etc.....	273
Barrels, stopping pores in.....	271	Microscopy in the United States.....	273
Bees-keeping in the Himalayas.....	275	Moles useful, are.....	277
Beller, coal burns in a (45).....	284	Moulders' wax (3).....	277
Beller, difficulty, a (9).....	284	Mustard, French (41).....	284
Beller, water in (36).....	284	Nitrous oxide and air (25).....	283
Book edges, coloring (31).....	283	Oil lamps, coal.....	280
Brass, softening (18).....	283	Paint, to clean.....	271
Brick machine, improved.....	271	Patent right notes.....	277
Business and personal.....	283	Patents, American and foreign.....	283
Chapman sea, the.....	283	Patents at auction.....	275
Chimney, moisture on (42).....	284	Patents, official list of.....	284
China-man and a ticket agent, a.....	274	Patterns on cloth, stamping (11).....	283
Chloride of calcium and dust.....	273	Pencils, indelible (30).....	283
Circle, area of a (7).....	283	Potassium xanthate.....	275
Crayons, colored (23).....	283	Quicksilver, coating with (37).....	284
Dentistry, artistic.....	275	Rust out of steel, to take.....	273
Door knob screws, holding.....	273	Scroll saw, grinder, and polisher.....	275
Dryers for coal tar (32).....	283	Self-made men.....	280
Dyspepsia and long life.....	271	Sewing machine monopoly, the.....	277
Eggs, dried.....	273	Shingles, preserving (43).....	284
Elephants, age of, etc. (39).....	283	Shipbuilding industry, our iron.....	273
Engine, clearance in an (9).....	283	Silk dresses, poisonous.....	274
Engraving, water evaporated.....	276	Snakes catching fish (4).....	283
England in America (30).....	283	Soap moulds (24).....	283
Fireproof curtain, metallic.....	277	Soluble glass paint (35).....	283
Fires, hotel.....	272	Spring fever, how not to have it.....	280
Fret saw patterns (5).....	283	Steel plates, thin (1).....	283
Glass, iridiated (16).....	283	Sulphate of quinine substitute.....	280
Glycerin (2).....	283	Telescopes, achromatic (57).....	283
Gold, tests for (12).....	283	Thermometer degrees (33).....	284
Grease, whitening (38).....	283	Tumblers, sounds from (40).....	284
Hair, the (19).....	283	Varnish from glass, remove (13).....	283
Hydrophobia, treatment of.....	274	Vision experiments, binocular.....	281
Inks, aniline stamping (38).....	284	War, European, and America.....	272
Invention wanted.....	273	Water and sodium amalgam.....	276
Inventions patented in England.....	282	Water elevator, improved.....	273
Iron pipes, protecting (34).....	283	Water in pipes (44).....	284
Iron, specific gravity of (9).....	283	Wine, acetified (21).....	283
Jugglery, marvelous.....	274	Wood for charcoal (35).....	284
Kerosene and water (17).....	283		

TABLE OF CONTENTS OF
THE SCIENTIFIC AMERICAN SUPPLEMENT,
No. 70,

For the Week ending May 5, 1877.

I. ENGINEERING AND MECHANICS.—The Dynamic Measurement and Utilization of Solar Heat, by JOHN EMICSON, with 3 engravings of novel apparatus.	
Determination of the Stress in Bowstring Girders, by Lieut. GEORGE S. CLARKE, R.E.; 4 illustrations.	
Locomotive for the Kahlenberg Rack Railway, near Vienna, with particulars and 5 illustrations to scale.	
The New Bridge, Pittsburgh, Pa.—The Ice Boat Wharf.	
The Edison Recording Steam Gauge, with 4 illustrations.	
The Rationale of Welding, by RICHARD HOWSON; including practical observations upon Mechanical Fastening.	
Lubrication. By Professor R. H. THURSTON. The Co-efficient of Friction, what it is; the Objects and Effects of Lubrication; Mechanical Devices to obviate Friction; Metallic and other Solid Anti-friction Compounds and Alloys; Liquid Lubricants, how they act; Pressures to be sustained by Lubricants, with Formula for Calculating the same; Table of Co-efficients of Friction of different substances; Averages of various Commercial Oils, with Table exhibiting comparative values, as Lubricants, their pressures, endurance, rise of temperature, and co-efficients.	
Inventions of the Century: Abstract from a lecture by Professor PLINY E. CHASE. The Chemical Lamp. Origin of the first Matches. Origin of Gas Lighting. Origin and Progress of the Telegraph. Origin of Agricultural and Textile Machinery. Successors from Cucumbers realized. Origin and Progress of the Steam Engine.	
Evans and Swain's plan for Fireproof Flooring of Solid Wood; 5 illustrations.	
The Grison Mine Ventilator and Engine; 3 illustrations.—The Bourdon Pressure Gauge; 3 figures.—Combined Engine and Clay Mill; 2 illustrations.	
Solid Steel Castings; how to secure the best results, avoid blow-holes, etc., by F. GAUTIER. An able, practical paper, lately read before the Iron and Steel Institute, with remarks by HENRY BESSEMER, A.L. Holly, and others. Full of useful information.	
Iron and Steel. By Dr. C. W. SIEMENS. A most interesting and valuable paper, containing accounts of the most recent practical improvements in the Production, Working, and Application of Iron and Steel; embracing the question of Labor in its relation to Capital, the Character, Value, Cost and Production of the various kinds of Fuel, including Bituminous Coals, Coke, American Fuels, Peat, Natural Gas Fuel, Artificial Gas Fuel, Liquid Fuel, Solar Fuel. Motive Powers and their Transmission over long distances. Water Power; its Transmission by Steel Ropes; its Transmission by Electricity. Wind Power. Bessemer Steel History. Siemens and Martin Steel. The Regenerative Furnace. The Open Hearth System. The Use of Ferro-Manganese. Use of Chromium. Production of Mild Steel. Piping of Steel. The Applications of Steel. Iron and Steel Nomenclature. Wrought Iron. Mechanical Puddling. Bell's New Process. Wrought Iron direct from the ore. Methods of protecting Iron and Steel from Rust. Alnshie's Method. Barff's Method.	
II. TECHNOLOGY.—Ornamental Wrought Iron Gate, Narten's design, 1 engraving.—Weakening Opaque Negatives.—Washing Prints.—Stoppers for Varnish Bottles.—Special Root Pictures.—Retouching Powder.—Cracking of Glass to prevent.—Photography in Lace Factories.—Photographic Reproduction of Blank Notes.—Substitute for Glass by Photography.—Cement for Wooden Boats.—Mordanting Cotton of Aniline Dyes.—Spontaneous Combustion of Silk.—New Respirator for Firemen.—Borate of Lime for Refining Sugars.—Pneumatic Clocks.—Free Flow in Sewers necessary.—Telluride of Gold.	
Pipes for Gas and other purposes.—With 4 illustrations.—Shear legs for lowering the pipes in trenches. Modification of same. Railway Winches for same purpose.	
III. ELECTRICITY, LIGHT, HEAT, ETC.—New Holtz Electrical Machine, by Professor ELIUS THOMSON, with 2 illustrations.—Decomposition of water with one electrode.—Fluorescence.—Caloric Intensity of Solar radiation.—The Light of the Rainbow.—Mock Sun.	
IV. NATURAL HISTORY, ETC.—The Woodpecker.—Sagacity of the Lobster.—Serve and Muscle Currents.—Siberian Explorations.—Ascent of the Alps.—Volcanic Lakes.—Rapid Growth of Coral.—Curious Facts about Ants and Caterpillars.—Weather and Velocity of Wind at Mt. Washington.—Why large Cities are Warm.	
V. AGRICULTURE, HORTICULTURE, ETC.—On the Preservation of Fodder in Trenches, by Professor CALDWELL; 2 illustrations.—Corn Sower and Hay.—Bassett Prize Ox Illingworth, 1 engraving.—Birds in per cord of 25 tons.—Number of pounds therein each of Nitrogen, Potash, and Phosphoric Acid. Table of Crops, Animals, and other chemicals. Value of Cow Manure. Nature and Chemical action of The Tulip Tree; its culture and rapid growth.—Best New Grapes.—Cultivation of the Pear.—Low-Headed Trees.—Liquid Grafting Wax.—Lime Dust for bugs, etc.—Garden use of Fertilizers.	

THE EUROPEAN WAR AS AFFECTING AMERICAN INVENTORS AND FARMERS.

The latest advices report that a war between Russia and Turkey is almost inevitable. Much as such a calamity is to be deplored, especially in these days when many have hoped that peaceful arbitration of national differences would permanently supplant the appeal to the sword, it cannot be doubted but that the conflict, if prolonged, will prove of material benefit to the people of the United States. And in no instance is this so apparent as in the great impetus which will be given to agriculture and to invention.

The two great grain-producing countries of the world are South Russia and the valley of the Mississippi; and between these sections there exists active competition for the supplying of the nine to fourteen million quarters of foreign wheat required by England, and the large additional amount needed by other European nations. Already in this rivalry our Western farmers are far ahead; and statistics, recently gathered by the Odessa (Russia) Committee on Trade and Manufactures for the information of the Russian Government, show with what remarkable rapidity this advance has been accomplished. The proportions of wheat supplied by Russia and the United States to England during the seven years from 1867 to the close of 1873, the period over which statistics have thus far been compiled, are as follows:

Year.	Russia, per cent.	United States, per cent.
1867	44	14
1868	32	18
1869	32	18
1870	38	21
1871	40	23
1872	51	24
1873	21	44

The committee say that they have reason to believe that the result for 1874 will be found even less favorable for Russia. It will be seen that within seven years the two countries have relatively changed places; and the Odessa committee frankly admit that in the near future the United States will be "so absolutely the controller of the prices of the London market that we shall be utterly unable to compete with them." Nor is this due to any decrease in the Russian supply, which the foregoing figures might seem to indicate had fallen off from 44 to 21 per cent in the period mentioned. Notwithstanding the increase from the new ports of export, Sebastopol and Königsberg, the Odessa export shows a constant increase in quantity as well as in value; and Mr. Arthur Arnold, from whose recent work relating to Russia we take the above facts, adds that "the conviction is forced upon us that Russian agriculture is stationary in comparison with the boundless and successful activity of the United States."

There are obviously two great events, either one of which, apart from the natural progress indicated by the foregoing, will tend to secure to us the supremacy of the grain trade. First, the magnificent success of Captain Eads' opening of the Mississippi, through which loaded vessels will be able to proceed directly from their river points of loading to Europe, and thus the export costs will, it is stated, be reduced fully 50 per cent; and second, the coming war, which bids fair to paralyze Russian agricultural activity, especially in the grain-producing country which is nearest to the territory of her enemy.

Already the market reports in this city show that, in view of the conflict, prices have been affected. Corn has advanced ten cents a bushel within a week, and the same increase has taken place in Chicago, doubtless through the same being held for further advance. If other nations become involved in the conflict, as appears possible, a wonderful effect on our market is anticipated by the Produce Exchange dealers, who are watching events. The closing of the Black Sea and Danube would send much of the shipping interest of Europe here, and low ocean rates would result; while this country would be called upon to make up the deficiency in the grain supply thus cut off. At the present time, owing to last year's short crop, we have little corn to spare; but next year, should the war continue and the crop prove good, the demand for both wheat and corn will, it is believed, produce one of the most exciting markets known for many years, and give large additions to the wealth of the country.

Another result of the war will probably be the requirement of the belligerents of improved weapons; and, indeed, for some time past New England factories have been filling Turkish orders for arms and munitions. We need hardly point out that the inventors will be by no means the class least benefited by the probable turn of affairs. The increased demand for grain will necessitate improved means for cultivating and harvesting, as well as for developing, the great fertile plains of the West, which will be converted into new grain-yielding territory. New means of clearing land, new draining implements, new plows and cultivators, new harvesters, new applications of steam power to agricultural machines, which will enable farmers to deal with immense fields and immense crops more rapidly and with greater economy of time and labor, will be needed. New grain-carrying vessels, new means of loading, new elevators, storage warehouses and granaries, new means of transportation—notably light, portable farm railroads—will all be called for. Such inventions will be needed at home. From abroad will come the demand for new firearms, torpedoes, cannon, accoutrements, camp equipage, field telegraphs, new signal systems, new projectiles, new adaptations of recently investigated explosives, and so on through the immense category of inventions so prolifically produced by American inventors

during our own war. The merchants are already watching their opportunities; the farmers will do likewise.

HOTEL FIRES.

The Southern Hotel, one of the largest and finest hotels in St. Louis, Mo., was recently burned. The fire broke out at a little after midnight. The house was filled with guests, many of whom were roused from sleep only to find all avenue of escape cut off. About a score of people, it is estimated, have lost their lives, and the building is wholly destroyed.

So long as the law permits the construction of edifices which are not fireproof, the public have a right to insist that such structures shall contain ample means for preventing fires and for the safety of the inmates. The recent Brooklyn Theatre conflagration has been the means of directing attention to the condition of auditoriums all over the world; and it has probably resulted in a great many precautions being taken which otherwise would not have been suggested. Hotels are nearly as inflammable as theaters, and they should be as carefully protected. The St. Louis building, although it is reported to have had an elaborate fire alarm system, with hose and taps on every floor, proved, by the rapidity with which it was consumed, that means supposed to be adequate were not so; and further showed that, for such edifices, not merely ordinary but extraordinary safeguards are required. Lofty hotels should have a fire escape at every window, besides bridges, wherever possible, leading from both roof and windows to adjacent buildings. It would cost very little also to place in every room about 60 feet of stout chain, firmly attached to the wall near the window. There should be huge tanks of water on the roofs, holding a supply sufficient to drench the building. The gas pipes also should have a water connection, so that every gas burner could be transformed into a fountain at will. Again, both in theatres and hotels, it has been found that shortly after the outbreak of the fire the gas has gone out, probably owing to the products of combustion cutting off the necessary supply of oxygen, or a pressure being generated which forces the gas back in the pipes. The remedy for this is the provision of separate lights, such as candles inclosed in tight glass lanterns connected with a ventilating tube or flue—or electric illumination might be used. There are few large hotels in the long halls of which a stranger might not easily mistake his way, and so, in case of danger, waste precious time. A hand balustrade along the wall leading to the stairways would in this respect be of the greatest use, even in the dark; and the walls besides might have directions painted on them in prominent characters for daytime use.

We have illustrated and described a number of simple fire alarms which give warning automatically. We published one quite recently, which was especially invented for hotels, it taking the place of the ordinary electric bell press button. This can be set to any temperature; and when the dangerous degree of heat is attained in the apartment, electric connection is instantly established, and an alarm, situated in any prominent locality, is sounded. It might be a good plan, also, in constructing hotels, to follow the compartment system, that is, to carry two or three principal partitions of solid brick clear through the house; and wherever there are openings, to provide them with heavy fireproof doors. In this way, one part of a building might be sufficiently isolated from the adjoining portion to allow of the prevention of the spread of fire to the whole structure. Mr. R. G. Hatfield, a well known architect of this city, says that iron beams and ties in flooring are not to be commended. The experience of Chicago and Boston shows that these beams are not to be trusted, since a moderate degree of heat deprives the metal of its power of resistance; and softened by heat, they yield by bending, and fall. Instead of iron beams and intervening brick arches, it is proposed to use wooden beams laid close, thus forming a solid floor of timber. Wooden beams are ordinarily set apart with spaces between them, and thus constitute, with the flooring and ceiling, an excellent arrangement for kindling or extending a fire. Setting the beams in contact with each other fills up the air-spaces and prevents the fire acting upon the beams, except in charring the surface to a small depth. There is reason for believing that a floor of this construction would resist fire better than one of iron beams and brick arches, while its cost at present prices would be but four sevenths of the cost of the latter.

If travelers and others who patronize hotels would take a few simple precautions for their own safety, there would be less of the loss of life that is now common. Hotel keepers will run their edifices skyward, as high as can be made to pay; but people should realize the risk incurred in accepting such quarters. By the aid of the elevator, the most aerial garret is perfectly easy of access; but it is well to remember that that elevator shaft in time of fire becomes a chimney to create draft, and generates a column of flame, which speedily attacks the lighter-built upper portion of the edifice. We know several cautious people with whom a coil of rope is as much a part of their luggage as their satchels. The rope takes up little room, and it may save life. A light wire ladder, which can be compactly folded, is even better. Some inventions of this kind are already in the market; but there is plenty of room for improvements. A wire gauze respirator, which can be tied over the nose and mouth, is another convenient article to have at hand when it becomes necessary to venture through smoke; or a wet towel similarly applied is equally good—especially if the wearer will keep on his hands and knees, close to the floor, where the least smoke is present. There is an excellent opportunity for inventors

to devise convenient and suitable devices of the kinds mentioned. Let us have some new ways of permanent protection for buildings; and meanwhile, who will be the first to put up a light ladder, a coil of stout rope, treated with tungstate of soda or other fireproof wash, so as to be unflam- mable, a respirator, and a self-lighting lantern, all in a case, which will take up less room than a Patent Office model? In- ventors might contrive a trunk, satchel, or portmanteau, with these arrangements stowed away in a special recepta- cle, and containing besides a box for holding valuables, made of asbestos pasteboard, which will withstand even the heat of a fierce furnace fire for some time. Pocketbooks of this material might be made, which, if lost in a burning building, would stand a good chance of being found in the ruins; perhaps, however, with the contents destroyed, unless they contained coin.

OUR IRON SHIPBUILDING INDUSTRY.

Messrs. David Brown & Co., a London shipping house, has recently issued a circular, practically addressed to Amer- ican shipowners, on the substitution of iron for wooden ves- sels, and on the supposed superior advantages existing in England for the construction of the former. After setting forth the advantages of the iron ships, the circular says: "It behoves American shipowners, therefore, to consider their disadvantageous position, in not being allowed to compete with those of all other countries by buying their ships in the cheapest market. The protective laws of the United States might serve the interests of shipbuilders if any builders pure and simple existed; but it does appear a hardship that the owners who, for the most part, now build their own ships, should be hampered by such restrictions, and have their shipping property confined to such ships as are built only in the United States. Iron ships in this country can now be built at about £13 10s. to £14 per ton, and with most profuse outfit."

It is true that American owners have not adopted iron sailing vessels to any such extent as have their English competitors; but there are reasons, notably the cheapness and abundance of wood in this country, the skill of our con- structors in producing fast and durable vessels of that ma- terial, besides others, which tend to account for the slowness of the substitution. The assertion in the foregoing circular which calls, however, for an exposition of the facts, which carry with them its denial, is that relative to the absence of builders in the United States, and the further inference that England is the cheapest market. The *New York Tribune* has recently published a valuable review of our iron ship- building industry; and this, in connection with the elaborate report which *Engineering* has lately given of shipbuilding on the Clyde during the past year, forms the basis of the fol- lowing:

Five years ago, in all the items that go to make up the cost of a ship, England possessed an incontestable advantage. Raw materials and labor were much cheaper than in the United States, while the facilities for shipbuilding were greatly superior. But in this short interval material changes have been accomplished. Shipbuilders in this country have erected rolling mills, furnaces, and shops; and a remarkably large amount of the best labor-saving machinery known has been invented and put in operation. One single builder, Mr. John Roach, has spent, including his original capital in- vested, some \$2,000,000 in supplying his yards and shops; and other builders have not fallen behind in proportionate outlay. Again, the price of iron has been reduced. Five years ago, pig iron ranged from \$45 to \$70 per ton in the United States. Since then, our imports, in view of the pro- gress made in the development of mines, have fallen from 800,000 to 165,000 tons, and the price is reduced to \$18 per ton—as cheap as anywhere in the world. Copper has fallen so in price that we are now exporting it. The great item, however, is labor, the cost of which constitutes fully 60 per cent. of that of a steamer, and at least 50 per cent. of that of a sailing vessel; or, starting with the pig iron and sawn lum- ber, it is estimated to amount to 80 per cent. of the cost of a steam vessel. This we have reduced by the invention of new labor-saving machinery, which the English do not em- ploy; and a reduction has also taken place owing to the gen- eral shrinkage in values, so that the price of labor here and in Europe is more nearly equalized. Mr. Laird, the great English shipbuilder, during his recent visit to this country, admitted that, with the appliances in use in American ship- yards, it might be possible, all other things being the same, for Americans to produce as cheap a ship as the English, and even pay the men better wages. It is not a question of "might," however, for our builders are now standing ready to furnish the class of vessels, specified in Messrs. Brown's circular, at Clyde prices; and Mr. Roach offers within the present year to complete any number of iron sailing ships, from one to six, for the same price (\$67.50 to \$70 per ton), referred to, and in currency, and to deliver the vessels on the other side, provided he has the privilege of taking a cargo in them. He guarantees them further to receive the best ratings from European and American insurance com- panies.

Our iron shipbuilding industry began in 1868; and since that time there have been built for American owners 251 iron vessels of all sizes, having a total tonnage of 197,500. The annual aggregate of iron vessels now built in this country is over 30, worth from \$12,000,000 to \$15,000,000; and the business is rapidly expanding. These figures are of course small beside the immense totals of the Clyde industry, at present; but for the four years beginning with 1873, the re-

turns shown by the latter are phenomenal, and the 1876 re- port indicates notable diminution. Vessels aggregating 224,000 tons were built in 1873; in 1874 the figures showed 266,000 tons; in 1876, 204,770 tons. It is suggestive to note that since 1873 the number of iron screw steamers built on the Clyde has steadily fallen off. Thus, in 1873, 125 were built; in 1874, 120; in 1875, 113; and last year but 83. Paddlewheel steamers show a slight increase, as follows: 1873, 14; 1874, 10; 1875, 13; and 1876, 16. Now in the face of this decline abroad, Roach alone reports the construction of 33 iron steamers, aggregating 68,150 tons, since 1873. This is an average of 13,630 tons per year for this builder, on these vessels alone (not counting all kinds, "from the tiniest yachts to ironclad ships of war," such as are included in the English reckoning); and this average, compared with the figures of individual English builders for 1876, would place the American concern third on the list—above John Elder & Co., and far ahead of the Napiers, whose total ton- nage for 1876 was but 9,111.

It needs but a brief examination of Mr. Roach's tabular statement, showing how he has invested nearly \$15,000,000 in iron shipbuilding within five years, to perceive how vastly profitable to the country this industry promises to become. Here, for instance, is the list of items of material and of ne- cessary expenditures: Plate iron, angle iron, deck beams, rivets, bar iron and forgings, pig iron, steel, ingot copper, sheet copper and brass, tin, spelter, brass tubes and condenser tubes, iron boiler tubes, brass boiler tubes, lumber, paints, files, hardware, bolts, nuts, rubber, oil waste, etc., steam pumps, windlasses, boats, wire and manilla rope, sails, blocks, steam and gas pipe and fittings, anchors and chains, lead, plumb- ing, coal, improved facilities for manufacture, new inven- tions in machinery, sundries, lamps, hose, glass, masts, cap- stans, etc., and wages. Of Mr. Roach's \$15,000,000, over \$7,000,000, or about 50 per cent, have gone for wages alone; plate iron takes about 17 per cent, and wood, cotton, hemp, etc., costs about 5 per cent of the whole. Sifted down to the crude raw material, it will be found that 80 per cent of the total cost of a vessel for skilled labor is a low estimate, and that 90 per cent would be nearer. Inspection of the list also shows at once what a large number of trades are directly benefited.

It may be added that our iron ships are not merely a source of national prosperity, but an important addition to our naval strength. All are constructed so as to be adaptable as men-of-war in case of necessity. Should such need ever arise, the government has at its disposal, free of cost, 50 iron screw steamers capable of steaming at the rate of from 10 to 14 knots per hour. In ten days, in other words, a fleet of better and stronger vessels than the famous Ala- bama could be gathered and equipped for predatory warfare on an enemy's commerce.

THE ADVANCEMENT IN MICROSCOPY IN THE UNITED STATES.

To all who take interest in the progress of scientific in- vestigation, it is a cheering sign that, in different parts of this country, the use of the microscope—that powerful appliance for investigating the secrets of Nature—is spreading rapidly by the establishment of microscopical societies in most of our large cities. At the late annual meeting of the American Association for the Advancement of Science, the members became acquainted with the Microscopical Society in New York city, which is in a very prosperous condition; and from time to time we notice, in various journals, reports of meet- ings of such societies which show that few of them are in- ferior in status to the Microscopical Society of this metropol- is, of whose annual exhibition we gave an account in our issue of April 7. The accounts of the recent meetings in San Francisco deserve a place in our columns.

The San Francisco Microscopical Society has fifty resident and forty corresponding members; it holds semi-monthly meetings; and at the annual reception, twenty members ex- hibited their instruments before three hundred visitors. It has a library of two hundred and fifty volumes, and a cabi- net of six hundred slides, besides much valuable apparatus—acquired by purchase and donation. It appears that the new Tolles objectives had previously not answered the ex- pectations of the members, as a failure in resolving the de- tails of some difficult diatoms was reported. Now, how- ever, the President stated that, in justice to Mr. Tolles, it should be acknowledged that the fault did not lay in his ob- jective, but in the members' inexperience, and that intercourse with experts in this special branch of work had rendered the solution so simple and easy that it caused wonder that it had ever appeared difficult. The one-tenth inch objective of Tolles most satisfactorily accomplishes all that was claimed for it; while the one-sixth immersion objective, by the same maker, gave a clearness of definition that was wonderful, and far surpassed anything which the President had ever witnessed. Not only this, but this glass possesses such ample working distance and such great penetration that it is ad- mirably adapted for investigation upon animal and vegetable tissues, for which these qualifications, especially distance, are so necessary.

The President reported the formation of a class for in- struction in microscopy, under the tuition of the librarian, Mr. Clark. The formation of such classes is of great im- portance, and was impossible a few years ago, when the mi- croscope was regarded as a novelty and a toy, rather than as a tool for the acquirement of valuable and important knowl- edge.

This San Francisco society is likely to cause some rivalry

and emulation among other associations; and the New York society must actively push the science of microscopy for- ward or it will be overshadowed by the growing institution on the Pacific side of this continent.

In Harvard University it has been concluded to establish classes for laboratory work with the microscope, with special instructions in its use for botanical study, the preparation of anatomical and other objects, etc. Professor Goodale has charge of the course on phenogamic botany, and Professor Farlow of that on cryptogamic botany. Their names are an ample guarantee of the excellence of this newly estab- lished department.

The microscopic societies in the United States are attract- ing attention in Europe; and in a microscopic journal pub- lished in London, England, we find accounts of meetings in some of our large towns. From Dunkirk, N. Y., it is re- ported that Professor J. Edward Smith, of Ohio, read a most interesting paper on "The Use and Abuse of the Microscope as an Instrument of Precision." He propounded several new ideas, such as the use of lenses of the widest angle of aperture for all kinds of work, and demonstrated practical- ly his proposition by an exhibition of various objects, some of them illuminated by oblique light thrown at an angle of 75° from the axis of the instrument, and some by a dia- phragm plate perforated with an aperture of $\frac{1}{100}$ of an inch in diameter, and with various amplifications from 500 to 2,000 diameters. Professor Smith also exhibited Tolles' $\frac{1}{10}$ and $\frac{1}{16}$ inch duplex objectives, of 180° air angle, and the President, G. E. Blackburn, M.D., a $\frac{1}{16}$ inch Tolles' immersion objective of 95° balsam angle. In view of the importance and value of some of the tests exhibited, a resolution of acknowledg- ment and commendation was drawn up and urged by the members and guests present. The report of the meeting is a very creditable indication of scientific progress in the young city of Dunkirk, which twenty-five years ago, when it was the first terminus of the Erie railroad, was a most in- significant country town. Had its growth and intellectual society, now realized, been predicted, the statement would have been deemed incredible.

For the benefit of those readers not conversant with the latest improvements in microscopic objectives, and therefore perhaps ignorant of the expressions "immersion objectives," "angle of aperture," "balsam angle," and "air angle," we will explain these terms.

The immersion objectives are lenses of which the extrem- ity has to be used immersed in a minute drop of water, placed upon the slide. The advantages are that loss of light by two reflections, namely, from the upper surface of the slide and the lower surface of the lens, is done away with, as the water drop unites their two surfaces and makes the lower lens of the combination and the covering glass of the slide practically one body. Next, the distance is increased, and a powerful lens, of which otherwise the focal length would be too short to be used with a covering glass, may, by the immersion system, be used at a more convenient distance without changing the magnifying power. As a result of the short focal distance, the working distance is considerably in- creased; but the great advantage of these lenses is their wonderful clearness and definition, which are of the utmost importance in examining minute objects accurately, so as to obtain a correct idea of their structure and not to be misled by deceptive appearances to which ordinary lenses of short focus frequently give rise.

In regard to angle of aperture, we ought to state that ex- perience has shown that central illumination often drowns minute details in a flood of light, and that objects can be better seen by oblique illumination; but with the latter, with ordinary lenses, the visible field is darkened. The makers of lenses have in some instances contracted them so that, even by very oblique illumination, the light reaches the eye, and the field remains bright. The extreme positions in which the light may be placed sideways from the axis of the instru- ment, and still be thrown in the axis, give us what is called the aperture; and the angle formed by the lines of these positions is the angle of aperture. The air angle is that ob- tained when the light passes through air only; the balsam angle is that obtained when the light passes through a slide of which the object is preserved in Canada balsam. As different fluids have different angles of refraction, they of course influence the angle of aperture.

We shall keep watch for news of further proceedings of these valuable societies, and hope to hear of the formation of new ones in all parts of this country.

Trials have been made in Rome of a solution of chloride of calcium as a substitute for water in laying dust in streets, and the results are said to have been highly satisfactory. The dampness communicated to the road remains for a whole week. The road remains damp without being muddy, presenting a hard surface, on which neither the wind nor the passing of pedestrians or horses has any effect.

C. M. writes to point out that minute objects photographed in large size by the help of a microscope are properly termed photo-micrographs; and that the minute photographs which require a microscope for their explanation are called micro- photographs.

E. N. L. writes to point out that a cracker-packing ma- chine is needed, and a successful appliance of the kind would amply reward the inventor, especially as it would be useful in many trades in which similar articles have to be pre- pared for shipping.

A NOVEL LIFE PRESERVER.

The lower portion of the curious device which is represented in the annexed illustration resembles a life-preserving dress; the upper part is a kind of buoy or floating chamber, in which the occupant has some freedom of motion for his head and arms. The object is to provide the shipwrecked person with not only a means of flotation but with complete shelter. Inside the enlarged upper chamber, it is proposed to place provisions and a water supply; so that the wearer can stay afloat for a month, if need be, with safety and comfort.

The interior of the apparatus is shown in Fig. 1. Fig. 2 represents it closed. The upper portion is made of strong sailcloth, waterproofed and distended on a jointed cylindrical frame. Across the lowest ring a diaphragm is placed, in which are two apertures for the legs, which are incased in waterproof pants and boots, covered with metallic rings, in order to afford protection against fishes and sharp rocks. These rings are made to fit one within the other when the dress is folded so as to enable the device to be stowed in small space. The top of the upper chamber is inclosed by a hood, in which a window is made. An air pipe is provided, leading to a respirator fastened over the mouth of the occupant. An annular air chamber is provided, which keeps the upper part of the apparatus well out of the water. Mr. Traugott Beck, of Newark, N. J., is the inventor.

How a Chinaman Caught a Ticket Agent.

Silver coin is at a discount in California just now, and it is customary to demand gold when the amount is over \$10, which explains the following from the *San Francisco Bulletin*:

"Too muchee smartee" was what the moon-eyed child of the Orient said to the ticket seller at the wharf when gold was demanded for three tickets to Stockton, at \$3.50 each, making \$10.50.

"Too muchee smartee; you no cachee gold allee time."

"Yes, John, I must have gold for these tickets—ten dollars and a half. Come, out!"

"How muchee one ticket?"

"Three dollars and a half."

"Allee light; me takee one," and he paid his three dollars and a half in silver; then bought another one and paid three dollars and a half in silver, and bought a third in the same way, having paid out ten dollars and a half in silver without showing any gold. With a look of triumph the mild-eyed son of Confucius gathered in his last ticket, and said:

"Too muchee smartee."

IMPROVED WATER ELEVATOR.

We illustrate herewith an improved steam pump for raising water by the direct action of the steam, in analogous manner to steam injectors. A is a steam-conducting pipe, which is placed within an outer pipe, and surrounded by coal ashes to prevent condensation. It is bolted, by a face plate, *a*, to a flanged casting, B, so as to be readily detached therefrom, for changing without removing the casting from the seats. The casting, B, is submerged in the water, and made of two flanged sections, which are jointed together, one section supporting, in suitable bearings, the nozzle, C, that connects with the steam pipe, A. The other section supports, in similar manner, a tapering spout, D, through the contracted opening of which the water is drawn through perforations, *b*, of the nozzle section, and forced by the action of the steam into the wider discharge pipe, A'. The latter is attached, by a face ring, *d*, binding on the flanged rim of the pipe, to the opposite end of the casting, B, so as to be changed with the same facility as the steam pipe. The action of the steam produces a partial vacuum and creates a suction that draws in the water to be raised, forcing it forward and upward to any height through the water-discharge pipe. The pump, it is claimed, may be used with advantage as a bilge pump on board of steamers.

This device was patented through the Scientific American Patent Agency, February 13, 1877, by Mr. Alexander Wright, of Havana, Cuba.

Poisonous Silk Dresses.

In purchasing silk, many require that the material shall possess both weight and stiffness, these qualities adding to its rich appearance and allowing it to be draped more gracefully. Heavy silk is also commonly believed to be of better manufacture and to wear better, as the extra weight is supposed to be due to a thicker and closer fabric. While all heavy silks are not necessarily weighted, a large proportion of them are.

The weighting of black silks with a compound of tannic acid and oxide of iron, far exceeding in quantity what is really needful for the production of a black color, has now been known for a considerable time, and has been carried so far as to deprive the material of its non-conducting power

for heat and electricity, greatly to impair its strength and durability, and even to render it liable to spontaneous combustion. Consumers, however, till lately "laid the flattering unction to their souls" that white and light-colored silks must be genuine. Alas! the depraved ingenuity of the age has introduced sophistication in this department also, and it is possible to buy white silks—white goods, rather—consisting of about one third to one half the genuine product of the silkworm, the remainder being made up with oxide or carbonate of lead. This stratagem is not merely a fraud upon the purchaser—who asks and pays for one thing, and receives another very inferior in its properties—but it is a direct attack upon public health, and (we learn from the *Chem-*

ical Review) in that capacity has already brought forth evil fruits. Persons who are continually handling such weighted silks are liable to lead poisoning. Still greater is the risk for milliners and dressmakers who sew with silk, and who are in the habit of biting off the end of the thread, or of putting it in the mouth to make it the better enter the eye of the needle. A minute quantity of lead is taken into the system each time; it remains and accumulates, and, at last, colic, palsy, and other alarming symptoms make their appearance. These are soon traced to lead poisoning, but not one medical man in a hundred will suspect how the lead is introduced into the patient's system. He will blame water, wine, vine-

Marvelous Jugglery.

The jugglers of India have for centuries been noted for their remarkable skill in the mysteries of the "black art." The editor of the *Commercial Bulletin*, traveling in the East, has contributed to that paper some very interesting letters on the customs of the strange people he has visited. Under the above heading he tells, in the last issue, his readers that "convalescence is a capital time for mild amusements which will not tire the languid brain, and we had some jugglers up almost every day. We never could find out their tricks, which are very marvelous. Of course, everybody has heard of the basket trick, where a small boy gets inside a basket, and the juggler plunges a sword through and through it, bringing it out reeking with blood, then holds up the basket, shows there's nothing there, and calls the boy, who calmly appears from outside the circle of spectators. And also of the mango trick, where a seed is placed in the ground, is covered with a cloth, and appears as a shrub, growing visibly before one's very eyes, and then bears fruit, which ripens and is edible in five minutes from first planting. These fellows have very scanty clothing, and apparently no apparatus whatever. There are some wisecracks who profess to know all about these tricks. I never saw the disemboweling and immediate healing of fakirs, in India, nor men sitting in the air, 'levitated,' as Madame Blavatsky calls it. But I have seen other tricks as surprising, and equally unaccountable by any art or science with which Europeans or Americans appear to be acquainted nowadays. I have seen a man throw up into the air a number of balls numbered in succession from one upwards. As each went up, and there was no deception about their going up, the ball was seen clearly in the air, getting smaller and smaller till it disappeared altogether out of sight. When they were all up, twenty or more, the operator would politely ask which ball you wanted to see, and then would shout out 'No. 1,' 'No. 15,' and so on, as instructed by the spectators, when the ball demanded would bound to his feet, violently from some remote distance.

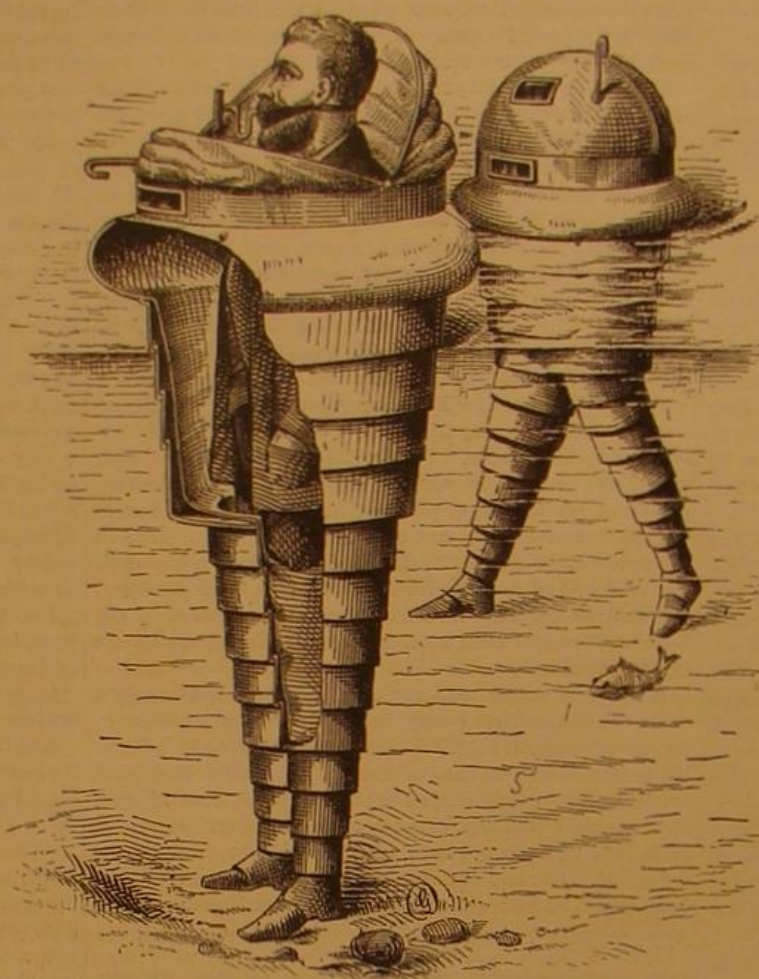
"Then I've seen them swallow three different colored powders, and then, throwing back the head, wash them down with water, drunk in the native fashion in a continuous stream from a *lotah*, or brass pot, held at arm's length from the lips, and keep on drinking till the swollen body could not hold another drop, and water overflowed from the lips. Then those fellows, after squirting out the water in their mouths, have spat out the three powders on to a clean piece of paper, dry and unmixed. As to the thimble-riggery of their minor tricks, they are exceedingly expert, but are probably equalled by many of our distinguished *prestidigitateurs*; and whatever may be said of the basket and mango tricks, or the sitting in the air, I don't think any of our people are up to the sending of balls into space and recalling them in an unpremeditated order. This reminds me of the trick Marco Polo, the great Venetian traveler of earlier times, speaks of having seen at the Court of Prester John, in Central Asia, when a bean was planted and sprung up rapidly toward the heavens, its summit being lost in the clouds. Up this, one juggler traveled, and then another after him, with a drawn sword. In a few minutes, down dropped ears, a nose, a head, and limbs of No. 1; No. 2 leisurely descends, wiping a bloody sword, shovels up the fragments of his victim into a box, and goes on with other performances, presently calling out for his defunct companion, who thereupon presents himself, as large as life, all alive and kicking, from the throng. This is not a modern trick, but those I have seen are certainly not less marvelous. Then, too, it is a well authenticated fact that some of these jugglers, on more than one occasion in recent years, have suffered themselves to be buried alive, and have been dug out alive after the lapse of a year."

Treatment of Hydrophobia.

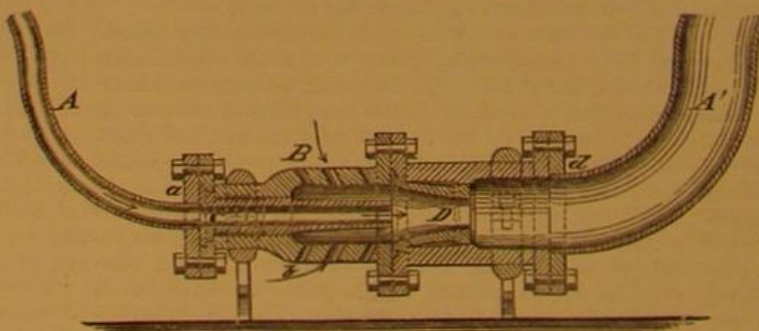
The following treatment of hydrophobia is suggested in the *Medical Journal*. The patient is to be undressed, seated on a cane chair, and the whole body up to the neck enveloped in blankets. Under the chair a spirit lamp is placed. This lamp is protected in a cage, on the top of which is a receptacle for the calomel (twenty or thirty grains), and a saucer for water. The flame beneath boils the water, and volatilizes the calomel. Moderate salivation, which is all that is required, says the writer, may be induced in a quarter of an hour, and judiciously repeated if the symptoms seem benefitted by the treatment. This treatment is said to have been successful in a case of hydrophobia in India during 1867.

Fig. 1.

Fig. 2.



BECK'S LIFE PRESERVER.



WRIGHT'S WATER ELEVATOR.

gar, food cooked in leaden vessels, etc. In the last guess he may often be right, for the tin with which saucepans are "tinned" is no longer tin, but an alloy containing a large proportion of lead. The so-called tins in which meat, butter, fruits, etc., are now imported and sold are also no longer "tins," save in a "Pickwickian sense," but "leads."

But, to return, so long as the silk is not recognized as the source of the lead, the patient will go on using it, and recovery will therefore be impossible. This, it must be understood, is no mere matter of conjecture or probability, but of actual fact. Poisoning cases of the kind described have already occurred, and will certainly become more and more frequent if the evil practice is allowed to continue.

The detection of lead is not difficult. If a piece of the silk, or a little of the thread or yarn suspected of being weighted with lead, is moistened with pure water and then

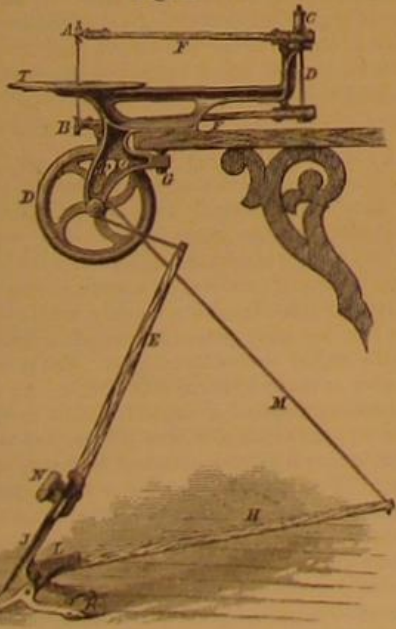
Potassic Xanthate.

This salt, the remarkable antiseptic properties of which were noted in a recent issue of the *SCIENTIFIC AMERICAN*, may be prepared by adding carbonic disulphide to an alcoholic solution of potash, or by the action of potassic sulphhydrate on neutral ethylic disulphocarbonate. If fused hydrate of potassium is dissolved in half its weight of absolute alcohol, and carbonic disulphide is added slowly till the liquid no longer exhibits an alkaline reaction, and the mixture is cooled to 32° Fah., the xanthate of potassium separates in colorless needles; and an additional quantity may be obtained by evaporating the mother liquor in a vacuum, after the excess of carbonic disulphide has been separated by water. But the salt is most easily prepared by adding to absolute alcohol an excess of very pure caustic potash, and then an excess of carbonic disulphide. The mixture immediately solidifies to a mass of interlaced silky needles, which must be washed on a filter with ether to free them from bisulphide of carbon, then pressed between fibrous paper, and dried over oil of vitriol. The salt crystallizes in shining, colorless prisms, which turn slightly yellow on exposure to the air. It is very soluble in water, and dissolves readily in 5 or 6 parts of absolute alcohol. It is insoluble, or nearly so, in ether. Its solution in absolute alcohol is not affected by boiling, but its aqueous solution decomposes when heated above 122° Fah., yielding potassic trisulphocarbonate, alcohol, sulphuretted hydrogen, and carbonic acid, thus: $2C_2H_5KOS + 2H_2O = K_2CS_3 + 2C_2H_5O + H_2S + CO_2$. In the dry state, it may be heated to 200° without alteration; but at higher temperatures it gives off ethylic sulphhydrate, sulphuretted hydrogen, water, and carbonic oxide, leaving a residue of potassic sulphide, mixed with charcoal. The solution heated with potash is resolved into mercaptan and potassic ethylmonosulphocarbonate. Strong nitric acid decomposes it with violence. Xanthate of sodium forms yellow needle-like crystals, resembling those of the potash salt, but of a darker color. The solutions of these salts form a yellow precipitate with salts of lead; yellow with copper salts (hence the name of the acid); light yellow with silver nitrate and mercurous salts; the last mentioned, however, quickly becomes brown and black.

THE DEXTER SCROLL SAW, EMERY GRINDER, AND POLISHER.

We illustrate herewith a scroll saw which has an entirely new treadle mechanism, and which is excellently adapted for amateur use. The frame, Fig. 1, is a solid casting, provided with a clamp, G, to secure it to a table or bench. The bows, F F, of hard ash, are fitted with iron plates on the back end. These plates have knife edges, carefully made, upon which the bows rock with little or no friction. The front ends of the bows are fitted with pivoted steel screw clamps, A B, for holding all sizes of saws. The plates on which these swing are adjustable, so that the pitch of the saw can be altered if desired, or corrected if it does not run straight.

Fig. 1.



The straining rod, D, is provided with a cupped nut, C, containing a spiral spring. This and the stop in the back end of the frame hold the upper saw arm still, and the lower one in place, when from any cause the saw is disconnected.

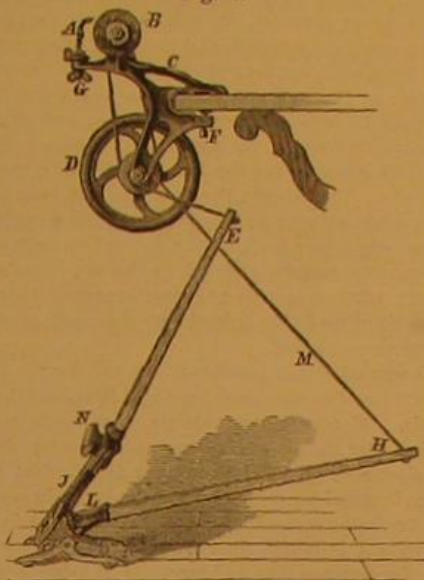
The treadle arrangement is a floor piece or frame, K, upon which is pivoted the foot piece and rod, J E, and the counter-rod, L H. The former is forced up and the latter down, or in opposite directions, by springs. A single cord or strap, M, the ends of which are fastened to the ends of the treadle rods, is passed over the hub of the driving wheel, D, in which is cut a V groove. Pressure on the foot piece forces the cord into the groove and causes a rapid rotary motion of the wheel; as soon as released the foot piece returns to its original position, throwing the cord out of the groove, the wheel continuing its forward movement; the slack cord is instantly taken up by the counter rod; the treadle is then ready for another propelling movement.

We are informed that with ordinary treadling 1,600 revo-

lutions of the wheel and strokes of the saw are made per minute; and as 800 to 1,000 strokes are ample for sawing, it will be seen that work may be rapidly executed with this machine with but little labor.

The same treadle motion has also been applied to an emery grinder and polisher, which is represented in Fig. 2. This is well suited for the uses of jewelers and dentists as well as for general employment. Wheels under 4 inches diameter and $\frac{1}{4}$ inch thick, of any grade or make, can be used.

Fig. 2.



Each end of the spindle is furnished with plate hubs for wheels with $\frac{1}{4}$ inch holes and fitted for a small chuck which will carry drills, burrs, and small-shanked dental wheels. An adjustable rest for work to be ground is attached. With ordinary treadling, a speed of 3,500 revolutions per minute is obtained. Patented October 24 and December 12, 1876. For further information, address Trump Bros., Wilmington, Del., inventors and manufacturers of the Fleetwood and Dexter machines.

Artistic Dentistry.

Dr. J. Allen, a well known dentist of this city, has recently shown us some very fine results of his process of enameling plates for artificial teeth, on which he has experimented the past thirty years. The plates are of platinum, and the enamel is so artistically and continuously applied that every characteristic of color and form of the natural parts is accurately reproduced. At the same time, by carefully disposing the teeth in their support and by the addition of ingenious arrangements for sustaining the muscles, Dr. Allen has succeeded in restoring to the face the natural expression and fullness, usually lost by the change of the features caused by the absence of teeth. The artificial sets exhibited to us deserve high rank as a product of art; and the process has already won the commendation of the dental profession as well as awards at the three last International Expositions.

Bee-Keeping in the Himalayas.

A correspondent gives, in the *London Agriculture Gazette*, an interesting account of bee culture in India. He writes: "Some of the villages make the keeping of bees their chief business; and although their method would perhaps hardly answer either with Englishmen or English bees, it is at any rate curious, and it is certainly very successful and exceedingly profitable."

"The houses are built of a framework of wood, which it would not be easy to describe without a sketch, but which leaves everywhere in the walls, both in their whole length and height, open spaces of about 2 feet high and from 10 to 12 feet long, which are subsequently filled up with stones and clay, after which the whole is plastered inside and out with a preparation of gypsum, which is found in abundance in the hills. The roofs are flat, of beaten clay, and the eaves project about 3 feet beyond the walls. As the whole weight of the roof rests entirely on the wooden framework, the stones and clay, with which any one of the spaces I have mentioned is filled, can at any time be removed and replaced without at all interfering with the stability. In each of these spaces, particularly in the walls facing the south, is placed one or more round earthenware waterpots, the height of which ought to be equal exactly to the thickness of the wall; these are built into the wall lying on their sides, with the round bottom outside, and its extreme convexity flush with the outside of the wall; whilst the mouth of the vessel, which is 5 or 8 inches in diameter, is flush with the wall in the inside of a room; in some houses there are as many as 40 of these waterpots (called ghurrahs in India) thus imbedded. All that is now wanted is to make a small hole on the outside convex bottom of each waterpot for the bees to enter—stick on a small patch of clay below it for them to alight on—put in a swarm and close the mouth of the pot with an earthenware lid made to fit. When honey is to be removed, all that is required is for the operator to enter the house, close the door, tap on the lid of the ghurrah to drive out the bees, or, if that is not sufficient, open the lid a little and blow in two or three puffs of smoke from a lighted rag, then open the lid fully and remove as much of the honey as may be deemed

expedient, after which the mouth of the pot is reclosed, and the bees soon return and go to work again; enough of the honey always seems to be left to support the stock through the winter, and I could not ascertain that artificial feeding is ever resorted to. As the houses are occupied by the family as well as the cattle of the owners, and in winter pretty constant fires are kept up, the bees, no doubt, benefit by the heat.

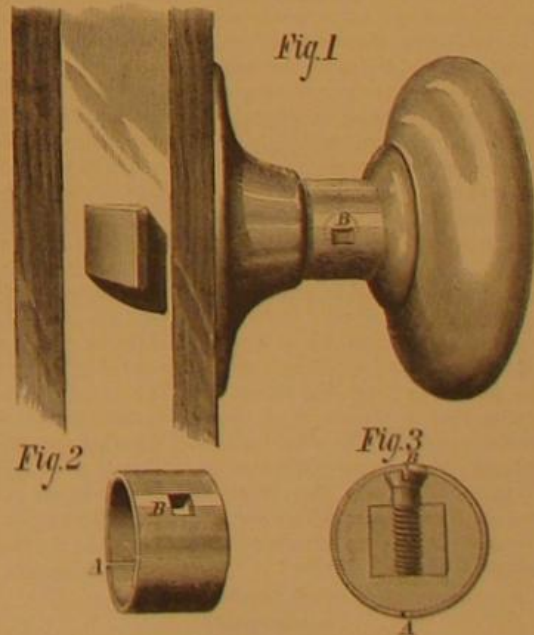
"Besides these hives, which are never killed off, each house generally has a large number of others, the result of swarming, which are managed in a different way. For these a hive is prepared thus: A piece of the trunk of a pine or cedar tree, of about 18 inches in diameter, is cut to a length of 2½ feet; this is split down the middle, and each half hollowed out in the center, so that when rejoined there is a considerable space inside. A hole is made in one of the halves for the bees to enter; and a swarm having been secured, it is lodged in the hollow log, the two parts of which, having been securely tied together, are then hung up close under the projecting eaves of the house and well out of the reach of bears, which are numerous in the district, and are very partial to honey. To get the honey from these swarms, I believe it is usual to destroy the bees; but I have heard, although I do not know exactly how it is done, that, instead of destroying all the bees, the queen only is sometimes killed, and the workers added to one of the stocks in the house wall, which may have become weak."

Dried Eggs.

A large establishment has been opened in St. Louis for drying eggs. It is in full operation, and hundreds of thousands of dozens are going into its insatiable maw. The eggs are carefully "candled" by hand—that is, examined by light to ascertain whether good or not—and are then thrown into an immense receptacle, where they are broken, and by a centrifugal operation the white and yolk are separated from the shell very much as liquid honey is separated from the comb. The liquid is then dried by heat, by patent process, and the dried article is left, resembling sugar; and it is put in barrels and is ready for transportation anywhere. This dried article has been taken twice across the equator in ships, and then made into omelet, and compared with omelet made from fresh eggs in the same manner, and the best judges could not detect the difference between the two. Is this not an age of wonders? Milk made solid, cider made solid, apple butter made into bricks! What next?—*Philadelphia Trade Journal*.

DEVICE FOR HOLDING DOOR KNOB SCREWS.

One of the commonest defects of the ordinary door knob is that the screws work loose, and thereupon the whole arrangement becomes shaky and liable to rupture. In the invention herewith illustrated, a simple little device effectually overcomes the difficulty. It consists of an elastic band, Fig. 3, of metal (steel or brass), of a proper width to suit the shank of the knob. A slit is made through the band, at A, and a small tongue, B, is also provided, which enters the



nick in the screw. The band is placed in position by springing it open and passing it over the shank. The tongue is then introduced in the screw slot, and the band allowed to spring shut. The parts then appear as in Figs. 1 and 2, the latter being a section through band and shank. Once in position, neither the band nor the screw can turn.

Patented through the Scientific American Patent Agency, April 3, 1877. For further information, address De C. May, 42 Mount Vernon Place, Baltimore, Md.

Patents at Auction.

A novel mode of disposing of patents is announced in our advertising columns. Mr. George W. Keeler, an auctioneer of experience, proposes to receive letters patents on consignment, which he will offer at public auction at stated intervals, in the same way as coal is disposed of monthly in this city.

Communications.

Novel Discoveries in Aerial Propulsion.

To the Editor of the Scientific American:

I recently picked up the *Galaxy* for April, 1873, and my attention was drawn to an article entitled, "Flight a Screw Propulsion." Glancing over it, I came to the following: "In 1867, Dr. J. Bell Pettigrew, of the Edinburgh University, before the Royal Institution of Great Britain, first propounded the now celebrated theory of the figure of 8 wave motion of the animal wing, and this has since been confirmed by the observations of Marcy."

"Pettigrew himself, before giving his conclusions to the public, had, with commendable caution, subjected them to careful verification."

"He continued his researches, and in 1868 published an elaborate memoir on the mechanical appliances by which flight is attained in the animal kingdom."

"During the wing's vibrations, it twists and untwists, so that it acts as a reversing, reciprocating screw, and resembles the blade of an ordinary screw propeller."

"The twisted configuration of the wing, and its screwing action, are due to the presence of figure of 8 looped curves on its anterior and posterior margins," and "Dr. Pettigrew has derived his ideas of the structure and movements of wings from careful anatomical study, and the most patient observation and experiment with winged animals themselves; and in view of these facts, he does not hesitate to avow the opinion that a thorough knowledge of this branch of animal mechanics will yet give man the power of artificial flight."

At considerable length the remarkable discovery by Pettigrew is entered into, and would seem to have been the result of years of observation, and promises still to be its object until man shall fly away on the strength of it. But it is evidently supposed by the great scientist that the main-spring of flight not only consists in the figure of 8 described by the extremity of the wing, but involves the necessity of particular muscles and sinews especially provided to give it the required twist.

In the first place, so far as regards the novelty of the idea that flight is accomplished by the screw propulsion of the wing, he has but to find himself forestalled by the SCIENTIFIC AMERICAN (in 1853, I think somewhere about October), wherein are two engravings of the propeller for which a patent was granted to Charles T. P. Ware, consisting of two elastic blades or wings, adjusted to an oscillating shaft, and which have their submerged reciprocating sweeps in an arbitrary plane perpendicular to the line of propulsion, forming a screw at each sweep. This arrangement, the inventor says that he adopted from his closest observations of the wing action in the swiftest of birds and insects, as well as the two-bladed tail of the East Indian swordfish. Indeed, the wings of the dragon-fly are so fixed in that position that they cannot be actuated in any other way. The idea, then, of screw propulsion in the animal wing would not seem to be quite so original with Dr. Pettigrew as he might have supposed, and to which he lends such weighty importance as a "discovery" long held secret until verified!

In conclusion, the screw action is not due to the figure of 8 configuration, the latter not being a cause, but an effect or consequence, of the propulsive movement of the wing. The very fact of the blade, or wing, being elastic, with the forward edge rigid and tapering, and the sweep forced rapidly and directly from upward to downward and *vice versa*, it could not impinge on the resisting medium (air or water) without describing at the tip that double loop from the points where it takes its start for every return stroke. This latter discovery, which is necessarily embodied and referred to as a feature demonstrated in practice, in Ware's patent, is therefore not only no novelty from the Doctor who is said to have first propounded the now celebrated theory, but shows that no mechanical appliances need be resorted to by inventive genius to twist the action into figures of 8, since, whether that be the secret of the motive force or not, it is already supplied by the simple action of the wing arbitrarily confined to a plane perpendicular to the direction of flight.

It therefore appears that, in the matter of the two great foregoing startling novelties, the SCIENTIFIC AMERICAN is at least about fifteen years ahead of Pettigrew and the Royal Institution of Great Britain!

LECTEUR CONSTANT.

Aeronautics.

To the Editor of the Scientific American:

I have noticed in some of your recent issues several articles on flying machines. The subject is one in which I have taken a great deal of interest; and as the conclusions at which I have arrived differ altogether from those of your correspondents, it is just possible they may give a new direction to the discussion.

I believe the invention of a machine, to fly by acting mechanically on the air, as birds do, is simply impossible if the machine, with its load, weighs more than 50 or 60 lbs. I do not say that a machine of any weight may not be constructed which shall be just a little heavier than the air displaced, and then the machine may be raised mechanically by acting on the air; but such a machine will, for reasons which follow, be little, if at all, better than a balloon. That which enables a bird to fly is the support which the pressure of the air gives to the bird's body. This support depends, I think, on the proportion between the weight and the surface exposed to the air. If the size of a bird is increased, all other

things being equal, the weight increases in a greater ratio than the surface exposed to the air; so that, if with a certain amount of wing area and muscular power a bird weighing 10 lbs. could fly well, and his weight were increased to 30 lbs., with muscular power and wing area increased in the same proportion, he could not fly at all. Or if an eagle grew as big as an elephant, he could no more fly than the elephant. Let us suppose that a bird of 10 lbs. weight is a perfect flying machine. Our object is to increase the size of the machine and keep the same perfection of parts. If the weight is doubled, keeping the same proportion of all the parts and using the same material, we will find that the muscular power has not quite doubled, and the supporting surface exposed to the air has not increased in anything like the same proportion; so that a limit is soon reached where the machine ceases to have any power of flight, and that limit, where muscular force is the power used, I take to be about 30 lbs. This accounts for the fact that all the largest birds are not fliers. The ostrich, the emu, and the moa ceased to be flying birds as soon as they grew beyond a certain size, which size was determined by the proportion between their weight and the surface exposed to the air. Geology also shows that, while mammals and reptiles grew in past ages to enormous sizes, no flying animal ever appeared much larger than those now existing.

In this way only is it possible to account for the fact that small particles of iron or steel dust will float for a long time in the air. Of course each particle is as much heavier in proportion than the air as if it were a solid cube several inches in diameter. This also accounts for the fact that the wing area in small birds is not nearly so large, in proportion to weight as in the larger birds; and the wing area in proportion to weight is still further diminished in many insects, such as the common bee and many of the beetle tribe. I have seen some small animals in this country, such as the opossum and the rock wallaby, fall 50 feet on a solid rock without injury; and this first set me speculating on the why. A bullock falling under the same circumstances would have been crushed, bones and all, to a shapeless mass; and yet the wallaby is not more strongly made than the bullock. I have stated my views as shortly as possible, and if I have not made them plain to general readers, I trust some mathematician among your correspondents may take the matter up and show that according to well known mathematical laws flying (as birds fly) is impossible for men.

Murrurundi, New South Wales.

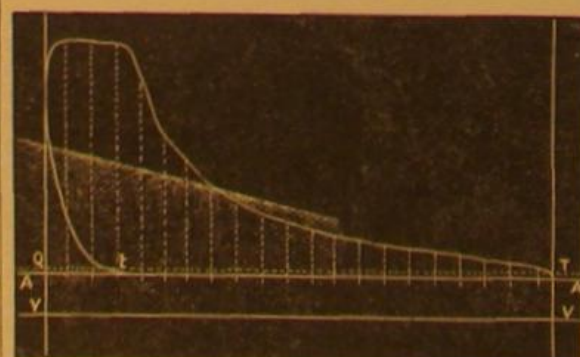
W. E. ABBOTT.

Water Evaporated through Engines.

To the Editor of the Scientific American:

I have before me the circular of an engine manufacturing company, in which the proprietors explain their method of computing the water consumption per horse power per hour, of any engine, from its indicator card alone. The method is as follows: "Divide the constant number 859,375 by the mean effective pressure of any diagram, and the quotient by the volume of its total terminal or exhaust pressure, the result will be the theoretical consumption in pounds of water per horse power per hour." "The constant number used is the piston displacement for one hour, in lbs. of water, of an engine which would develop one horse power with 1 lb. pressure of water instead of steam. Then, with pressures of more than 1 lb., the amount required would be as many times less as the pressure was greater than 1 lb.; and when steam is used, the amount would be as much less as the volume of the steam at the pressure at which it is released is greater than an equal weight of water. The volumes of the pressures are taken from Forney's 'Catechism' and Roder's 'Handbook.'"

It is easy to see that if the steam in the cylinder followed, strictly, Mariotte's law of expansion, and if the valve and piston fittings were perfect, this would be a very accurate, as it is a simple, rule to go by; but as indicator cards give us but very little clue to the amount of leakage and condensation, a considerable amount of water will pass through the engine, for which the rule makes no allowance. Indicator cards are of great value in determining the initial, mean effective, and terminal pressures, the back pressure, the cushion, whether by compression or lead, the point of cut-off, and the relative economy of different engines, aside from leakage and condensation. As so much depends upon the construction of the engine, it seems to me that no definite rule can be given for arriving at a near result. I inclose



herewith a card taken from a 12x20 inch automatic cut-off engine, to which I will apply the rule, for the purpose of explaining it more fully: A A is the atmospheric line, and V V the vacuum line. The initial pressure is 72 lbs.; the mean effective pressure is 25½ lbs.; and the total terminal

about 16 lbs. (measuring from vacuum line). The cut-off is effected at about 16 per cent of the stroke. Applying the rule to this card, we have $859,375 \div 25\frac{1}{2} = 33,834 \div 954 = 35.46$ lbs. of water per horse power per hour (954 being the volume of the 16 lbs. pressure).

When cushioning by compression is employed, a part of the steam is saved; so that, when greater accuracy is desired, we proceed thus: "Multiply the result obtained by the rule by the length of the dotted line, T, t, and divide the product by the length of line, T, a." I would like to hear from others on this subject.

Hinckley, Ohio.

W. A. MUSSEN.

Decomposition of Water by Sodium Amalgam.

To the Editor of the Scientific American:

In a recent number of your valuable paper, my attention was drawn to the article by Professor Merrick entitled "Mortification and Water," taken from the *American Chemist*. As I have repeated the experiment a number of times, and have had precisely the same experience in breaking the glass vessel, I at last hit upon the method of forming an amalgam of the sodium with mercury, which not only makes the decomposition of the water to take place slowly, but, by increasing the weight of the sodium, may be conveniently kept in a small capsule of porcelain at the bottom of the jar, and the minute bubbles of hydrogen rise rapidly through the water, thus increasing the beauty of the experiment. A wire cage may be also employed for confining the sodium; and such an instrument, furnished with a handle, can be bought in our stores where philosophical and chemical apparatus are sold. A tea ball, made of wire gauze, and intended to keep the leaves of the tea together in the pot, may also be pressed into service; but of all the plans proposed I decidedly prefer the amalgam one, which will also answer, when thrown into a solution of ammonium chloride, for forming that remarkable compound which, when seen for the first time, excites so much wonder, namely, the ammonium amalgam.

Philadelphia, Pa.

ISAAC NORRIS, M.D.

[For the Scientific American.]

EXPERIMENTS WITH LOCUST EGGS, AND CONCLUSIONS DRAWN THEREFROM.

BY PROFESSOR C. V. RILEY.

There are many questions respecting the manner in which the eggs of the Rocky Mountain locust are affected under different conditions, which are of intense practical interest, and which are frequently discussed with no definite result being arrived at, or no positive conclusion drawn. Such are, for instance, the influence of temperature, moisture, and dryness upon them; the effects of exposing them to the air, of breaking open the pods, of harrowing or plowing them under at different depths, of tramping upon them. Everything, in short, that may tend to destroy them or prevent the young locusts hatching, is of vital importance. With a view of settling some of these questions, and in the hope of reaching conclusions that might prove valuable, I have carried on during the past winter a series of experiments which will be reported in detail in my 9th report, and the conclusions drawn from some of which I give you herewith:

Nine experiments, to test the

EFFECTS OF ALTERNATELY FREEZING AND THAWING.

showed that: 1st, the eggs are far less susceptible to alternate freezing and thawing than most of us, from analogy, have been inclined to believe. Those who have paid attention to the subject know full well that the large proportion of insects that hibernate on or in the ground are more injuriously affected by a mild, alternately freezing and thawing winter, than by a steadily cold and severe one; and the idea has quite generally prevailed that it was the same with regard to our locust eggs. But if so, then it is more owing to the mechanical action which, by alternate expansion and contraction of the soil, heaves the pods and exposes them, than to the effects of the varying temperatures. 2nd, that suspended development by frost may continue with impunity for varying periods, after the embryo is fully formed and the young insect is on the verge of hatching. Many persons, having in mind the well known fact that birds' eggs become addled if incubation ceases before completion when once commenced, would, from analogy, come to the same conclusion with regard to the locust eggs. But analogy here is an unsafe guide. The eggs of insects hibernate in all stages of embryonic development, and many of them with the larva fully formed and complete within. The advanced development of the locust embryo, frequently noticed in the fall, argues nothing but very early hatching as soon as spring opens. Their vitality is unimpaired by frost.

A series of sixteen experiments, to test the

INFLUENCE OF MOISTURE UPON THE EGGS.

establish a few facts that were somewhat unexpected. I give one of the experiments as a sample. The insect is a denizen of the high and arid regions of the northwest, and has often been observed to prefer dry and sunny places, and to avoid wet land, for purposes of oviposition. The belief that moisture was prejudicial to the eggs has, for these reasons, very generally prevailed. The power which they exhibit of retaining vitality and of hatching under water or in saturated ground is, therefore, very remarkable—the more so when viewed in connection with the results obtained in the succeeding experiment. That the eggs should hatch after several weeks' submergence, and that the young insect

should even throw off the post-natal pellicle (*ambion*) was to me quite a surprise, and argues a most wonderful toughness and tenacity. After being dried and soaked for over six weeks, under conditions that approach to those of spring, I found a good proportion of the eggs to contain full-formed and living young larvae, which, though somewhat shrunken, and evidently too weak to have made their exit, were still capable of motion. The water evidently retards hatching. An examination of the submerged eggs that remained unhatched, long after others had hatched which had been under similar treatment up to a certain time and then transferred to earth, showed the jaws and tibial spines to be still quite soft. It is, therefore, in preventing the proper hardening of these delivering points that water doubtless retards the hatching, and prevents its accomplishment long before the embryo perishes. Yet, when once life has gone, the egg would seem to rot quicker in the water than in the ground.

The experiments, further, prove conclusively that water in winter time, when subject to be frozen, is still less injurious to the eggs. Altogether, these experiments give us very little encouragement as to the use of water as a destructive agent; and we can readily understand how eggs may hatch out, as they have been known to do, in marshy soil, or soil too wet for the plow, or even from the bottom of ponds that were overflowed during winter and spring. The only instances in which water can be profitably used is where the land can be flooded for a few days just at the period when the bulk of the eggs are hatching.

Several experiments, to test the

EFFECTS OF EXPOSURE TO THE FREE AIR.

proved very conclusively that we can do much more to destroy the eggs, by bringing into requisition the universally utilizable air, than we can by the use of water. The breaking up of the mass, and exposure of the individual eggs to the desiccating effects of the atmosphere, effectually destroys them; and when to this is added the well known fact that thus exposed they are more liable to destruction by their numerous enemies, we see at once the importance of this mode of coping with the evil.

Five experiments, to test the

EFFECTS OF BURYING AT DIFFERENT DEPTHS.

showed that, where the newly hatched insect has not the natural channel of exit prepared by the mother, it must inevitably perish if the soil be moderately compact, unless cracks, fissures, or other channels reaching to the surface, are at hand.

From the four series of experiments mentioned I draw the following deductions, which have important practical bearing: 1. Frost has no injurious effect on the eggs: its influence is beneficial rather, in weakening the outer shell. 2. Alternately freezing and thawing is far less injurious to them than we have hitherto supposed, and tends to their destruction, if at all, indirectly, by exposing them to the free air. 3. The breaking open of the egg masses, and exposure of the eggs to the atmosphere, is the most effectual way of destroying them. Hence, the importance of harrowing in the fall is obvious. 4. Moisture has altogether less effect on the vitality of the eggs than has heretofore been supposed, and will be of little use as a destructive agent except where land can be overflowed for two or three days at the time when the bulk of the young are hatching. 5. Plowing under of the eggs will be effectual in destroying them just in proportion as the surface is afterward harrowed and rolled. Its effects will also necessarily vary with the nature of the soil. Other things being equal, fall plowing will have the advantage over spring plowing, not only in retarding the hatching period, but in permitting the settling and compacting of the soil; while, where the ground is afterwards harrowed and rolled, the spring plowing will prove just as good, and, on light soils, perhaps better.

Are Moles Useful?

The season for these annoying creatures to begin their annual work is at hand; and very soon evidences of their presence will be observed on the lawns and in the gardens of many an agriculturist. The question whether moles eat vegetation, or only destroy it in search for worms, is a mooted one; and almost every season the discussion is renewed in our agricultural papers. A correspondent states, in the *Ohio Cultivator*, that the present winter, when the thermometer was down to 23° Fah. below zero, moles were found in fodder shocks, where they had collected some corn, upon which they live, and some of which was found in their stomachs, and no other food was distinguishable. Of course, moles found in different places, adds the writer, live upon different food; some on the bark or the roots of trees, etc.; and the above is corroborated by the *Rural New Yorker*, who does not care whether high or low authorities declare that ground moles eat nothing but insects, but says that the assertion is simply false, and any man who possesses skill enough to catch a live one can prove it to be so. The ground mole will devour earth or angle worms when in confinement or at liberty, and those worms are not insects. Furthermore, this worm, *lumbicus terrestris*, is the mole's principal animal food, if our own personal observation, says the *Rural* editor, has not led us far astray. But leaving the food out of the question, a vigorous ground mole will lift up and kill a row of plants in far less time than a thousand of our most noxious insects, not excepting grasshoppers and potato beetles. It is to be feared that our authorities who talk so glibly about the useful mole know little of cultivating gardens infested with these pests. One season of gardening

with a dozen moles per acre would satisfy them to dispense with these secret subterranean assistants.

And here comes a defence of the mole from across the water. "In some parts of Belgium," says a contemporary, "attempts have been made to extirpate the moles from the soil. At one of the chateaux in that country, surrounded by a park adorned by fine lawns, men were employed to catch and kill the animals. After a time they were killed off, and disappeared entirely, in consequence of which the velvety grass of the lawns soon withered. The cause of the mischief was a small white insect which had been killed by the moles. The proprietor of the chateau, after he had made the discovery, was obliged to stock his place with a fresh supply of moles, after which the lawn flourished as before."

Having experienced considerable annoyance from these destructive creatures, we have read with special interest whatever agricultural papers have had to say about the moles' habits, their destructiveness, and their utility; and we have arrived at probably about the same conclusion that most persons who read the above have already reached. The heading of our article may provoke a discussion in some debating society, which will determine the mole's future. A great many who have waited in vain for the agricultural writers to settle the mole's destiny will certainly rejoice if his fate be sealed.

The Sewing Machine Monopoly.

A correspondent of the *Philadelphia Enquirer* writes from Washington to that paper as follows: "A number of lobbyists, representing an immense sewing machine combination interest, have made their appearance here. Their object is to procure, by some means not now apparent, a renewal or extension of patent upon the feed motion, which is vital property, and the basis of the Wheeler & Wilson, Howe, Singer, and other sewing machine combinations. The patent has already been extended and will expire on the 8th of May. It was the original intention of the great sewing machine pool to go to Congress and procure an act enabling the Patent Office to again extend the monopoly, but the excitement of the electoral count prevented them from putting this plan into operation."

"The agents of the pool now have, it is said, a very large sum of money at their command, and will thus be able to make a persuasive argument before the Patent Office people. Their case is in an awkward shape, and will expire by default on the day above indicated unless some action can be procured from the patent officials which will give the pool the color of a claim upon which to go to Congress when it sits. It is possible, however, that an application for a new patent covering the principle, in a slightly varied form, will afford means of escape from this dilemma, if adopted by the secret workers of the monopoly."

"The enormous benefits to accrue to the public in the event of the sewing machine pool falling to buy an extension will be seen when it is considered that the manufacturing cost of an ordinary \$65 sewing machine is about \$6.25, while an \$85 machine from the Bridgeport shops costs in the frame, ready for shipment, something under \$10. As things are now, a \$65 machine is put to the local agent at \$25, and the agent gets \$40 for his time and labor in selling and instructing. An \$85 machine costs the agent \$35, so on up to the fancy, full cabinet, pearl inlaid article, which costs the customer from \$150 to \$200. The same rule applies in about the same proportion to all machines in the combination."

"The breaking down of the monopoly which sustains these ruinous figures will enable any machine shop in the country with proper appliances to turn out sewing machines with the lock stitch and wheel or ratchet feed. Competition will thus bring down the price of machines to a legitimate figure, about one half the present rates. This, a patent official remarks, may result in curtailing the agency system to some extent, but he adds that it is a system which deserves curtailing on account of the pertinacity of competing agents in attempting to force their wares upon a forbearing public. The patent men are exhibiting pretty much the same forbearance toward the pool emissaries here that the public exhibit toward sewing machine agents, and it is quite possible that the country may for a time be cheated out of the profits of which the law entitles it."

Patent Right Notes.

A rather important decision was made in the United States District Court at Cincinnati, a few days ago, involving the standing of notes given for patent rights. Pennsylvania was, we believe, among the first States to enact a law requiring that such notes should bear upon their face the words "given for a patent right," further providing that notes so distinguished shall, in the hands of any third parties, remain subject to all the equities between the original parties. The same law was subsequently enacted in Ohio and other Western States for the purpose of stopping the frauds which have been from time to time committed by patent right dealers upon innocent and unsuspecting farmers. In the case heard before Judge Swing, at Cincinnati, the defendant offered to prove that he had been defrauded, and insisted that he was not bound to pay the note, and claimed that the present owner of the note, who bought it before due, was bound, under the Ohio law, to permit such a defence to be made. Judge Swing, however, took a different view, and pronounced the Ohio law unconstitutional, saying in substance that the insertion of the words "given for a patent right" is no protection to the maker, and of no force whatever. He decided this upon the principle that such a

law impaired the value of patent right property, a species of property created by the Constitution and laws of Congress, and as such entitled to all the protection given to any other property, and not properly the subject of individual discrimination. The Indiana courts have decided the same way.

American Competition in the Hardware and Implement Industries.

We last month, says the *London Ironmonger*, drew attention to the activity of American hardware producers in seeking to dispose of their products in this country. That activity has not, during the month, diminished. On the contrary, more diligence is noted. The number of representatives of American firms visiting our own hardware districts and the leading buying centers of Great Britain is larger now than it was a month ago. American travelers, directly representing American firms, bid fair soon to occupy a conspicuous place on the list of those who call upon English hardware merchants and wholesale ironmongers, nor can it be said that their prospects are altogether cheerless. It is true that, like most other people of their class, they carry specimens of excellent and also of indifferent goods. Goods, some cheap, others dear: goods which sell themselves and goods which need pushing.

As previously, so now, the Americans are successful in cutting and cultivating tools. Axes and spades, forks and scythes, find the most ready sale, and the thousand and one labor-saving apparatus, so handy in the kitchens of boarding houses, hotels, and the like, prove tempting at first sight, though they have not invariably the quality of endurance. While the makers of such products at home are thus vigorously elbowing at their own doors by American competitors, English engineering and light iron foundry firms have not exemption. In addition to light castings of the sort particularized last month, heavier and more complicated products of the engine shop and the foundry are presented by those same American travelers. Handy machinery required by the manipulator of metals and wood, in the turning and in the casting shop in particular, are brought under the notice of Englishmen. Nor are the makers of New World implements required by the farmer any less active than for some time they have been. Rather, more agencies of American agricultural implement firms have been formed, at the same time that business direct is being increasingly cultivated by firms who have not before done business in England, and in goods not previously offered.

More significant, however, to the British hardware and implement manufacturers is the competition of the American in the foreign markets before largely supplied from English works. In this direction even more activity and ingenuity is noticeable than in respect of Great Britain itself. If equally recent information be accurate, English agricultural implement manufacturers have cause for some apprehension as to the market for agricultural implements in Russia. The statement is that, convinced that American plows and other labor-saving farm tools are more adapted to the cultivation of the soil of Russia than goods of English make, several Russian Boards of Agriculture have appointed an agent in New York who has already given orders for tools and implements—one order being to a firm in Louisville, Kentucky, for 10,000 plows. It is added that a pattern of a mowing machine adapted to Russian soil has also been selected, and that a considerable number are being made; whilst experiments are in progress in New England to ascertain the best kind of portable engine for Russian employment. Though the account may not be wholly devoid of the exaggeration which frequently accompanies intimations of the kind, there is probably truth enough in it to make it at least unpalatable to those manufacturers in England to whom the farmers in Russia have formerly come for a supply of implements. It is not with satisfaction that we are compelled to supplement this with the statement that American plow makers have devised a plow to be drawn by native oxen, which threatens to supersede in numerous uses the Caffre mamootie, which has for so many years formed a profitable branch of British edge tool manufacture. Further, that a British hardware merchant has, during this month, been required by a Cape customer to send out, not English, but American hardware. The consignment will be a valuable one, and it will embrace nearly all the classes of hardware which have hitherto been sent out to the same customer. In this case the order is an experimental one; but taken in connection with the foregoing, it is one to which it is our duty to direct the prominent attention of English hardware firms.

Metallic Fireproof Curtain.

A fireproof curtain for theaters, made in corrugated plate by Voss, Mitter & Co., of Berlin, is soon to be tried. It is being fitted to the theater in Dresden, now rebuilding after destruction by fire. Exposed to heat, a brisk circulation of air is set up in the sections of tubes formed by the corrugations, the heated particles ascending, and colder particles flowing in to supply their place. The latter keep down the temperature so considerably that a sweating breaks out in the plate of which the curtain, or shutter, as it is, speaking strictly, is composed. The shutter made for the Dresden theater is 40 feet high and 46 feet wide. The method of riveting the plates of which it is composed, and of raising and lowering it, are the subjects of patents.

We have to correct an error in our article on the results of evaporation and rainfall, in our last issue. We should have said that the waters of the Caspian Sea are less, and not more, salt than those of the ocean.

THE EXPORTATION OF AMERICAN MEAT TO ENGLAND.

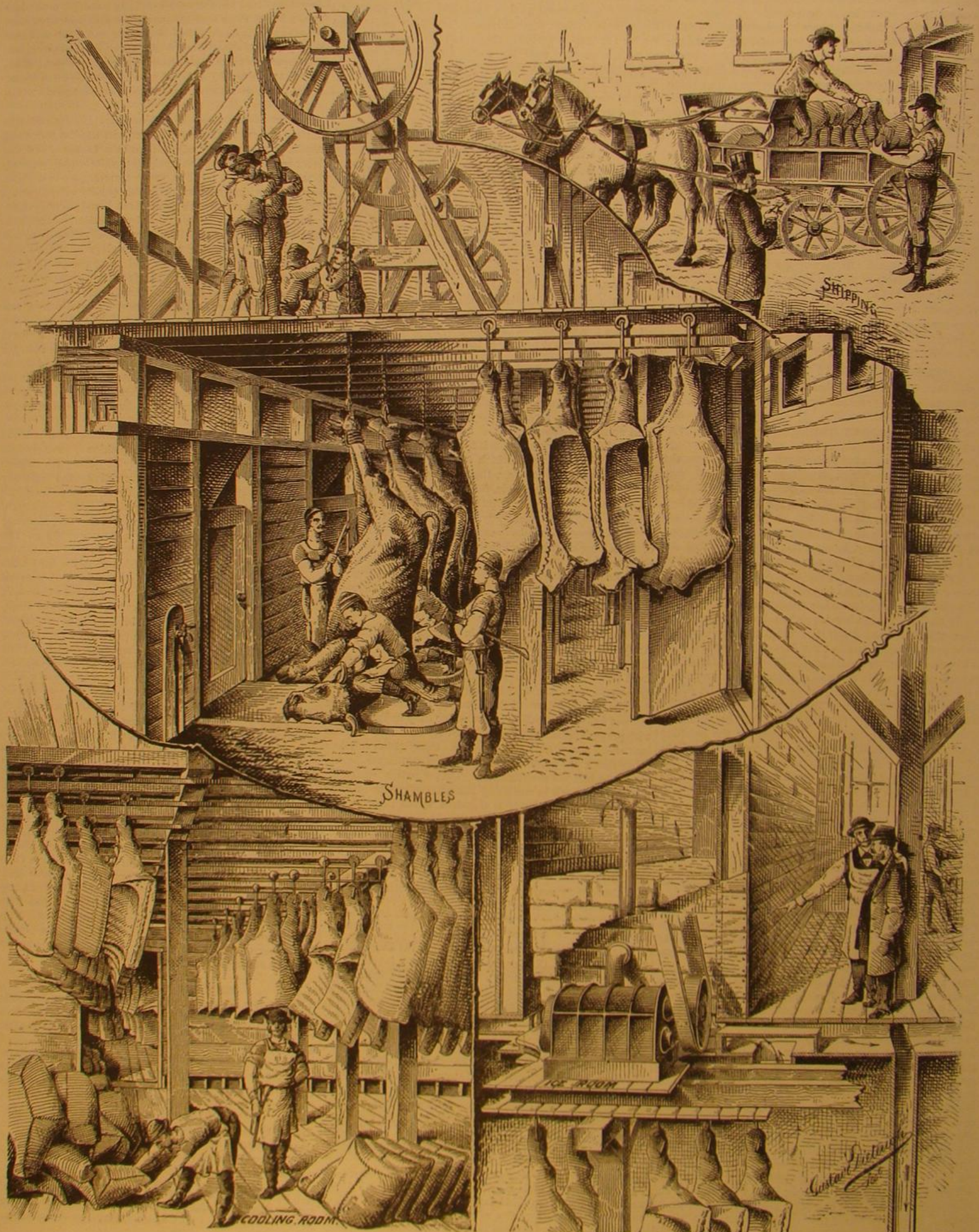
We have already made passing reference to the large export trade of American meat which has been established since last summer between this country and Great Britain. The first shipment, made in June, 1876, consisted of 432 quarters of beef and 70 sheep, the whole weighing in the aggregate 81,000 lbs. At the present time the weekly export is nearly 300,000 lbs., and a still further increase is confidently expected, so that it may be fairly considered that the foundation of a new commerce, which will be beneficial not merely to dealers in live stock, but especially so to our farmers and cattle raisers, has been successfully laid. The whole secret of the possibility of transporting the meat and delivering it in England and Scotland, possessed of better keeping

qualities than even the meat killed on that side of the Atlantic, is found in the simple fact that a dry atmosphere having a constant temperature of from 36° to 38° Fah. is employed. Care is taken that the freezing point is never reached. The meat is also thoroughly chilled immediately after killing, and thus starts on its journey entirely free from its natural animal heat.

The cattle from which the beef for the foreign market is derived—and in the following article we shall refer to beef only, as the export thereof is considerably larger than that of mutton—are raised in Illinois, Ohio, Indiana, and Kentucky. The largest dealer and shipper, as well as the first to undertake the export, is Mr. T. C. Eastman, of this city. He informs us that the steers are ordinary American cattle, se-

lected by his buyers principally in Chicago, and devoted to foreign shipment on account of their superior condition. Stringy Texan stock and poor animals generally are not sent abroad. The steers are purchased by middle-men from the farmers and raisers, and are driven into Chicago. Thence they are shipped to New York, the journey lasting about five days, and are delivered in the stock yards of the New York Central and Hudson River Railroad Company, at the foot of 60th street. The slaughter-house occupies a portion of the immense cattle building there located, an edifice which is the largest of its class in the world.

The animals selected for shipment are driven from the yards into a central passage in the basement of the buildings, and thence into pens which open directly upon the shambles.



The scene in that sanguinary locality is represented in our engraving. There is an atmosphere of blood and steam. Men—models of magnificent physical condition—work rapidly upon the suspended carcasses, using their keen knives with the dexterity of surgeons. No one wastes any time. The red door of a pen is swung open, the hooked rope from one of the many huge pulleys above is hitched around the hind leg of a steer, and, before the astonished animal fairly realizes the novel sensation of being hung up by the heels, the sharp knife has pierced his throat and the life blood rushes forth. Instantly a number of men attack the body: some skin it, others remove hoofs, others the interior, and thus in a very few minutes the animal is cut up, and his reeking quarters are shifted upon traveling hooks which move along the iron railways suspended from the beams. One thousand steers a week are killed in this manner, or an average of one ox every three minutes during working hours.

The various overhead tracks lead into the cooling rooms, of which there are six, three on each side of the building; so that the quarters can be moved, without any lifting, directly into these apartments, and there left until the time for shipping arrives. The construction of one of the ice boxes,

showing how the cooling room beneath is rendered of the proper temperature, and also a view of the interior of one of the cooling rooms, are given in our first illustration. The ice box is a huge double-walled room, placed in the story above the cooling apartment and capable of holding over a hundred tons of ice. It has no openings, save one in the ceiling for the insertion of the ice and the necessary apertures for the escape of air driven through the frozen blocks. The blast is generated by a powerful blower, impelled by steam and located outside the box. This forces air into the receptacle at the top; and the current, descending, passes through the ice, thence through apertures at the base of the sides of the room, then down through the walls of the cooling chamber, and enters the latter near the floor. Meanwhile, there is a conduit from the upper part of the cooling chamber to the blower, which in this case acts as an exhaust, drawing the hot air from the top of the cooling room and constantly replacing it with the cold air forced in below.

After the meat is thoroughly cooled, it is sewn in strong canvas bags, and sent aboard the steamers. At present six of the vessels of the Anchor line are fitted each with two refrigerators, these being capable of holding from 180 to 235

carcasses each. Our second engraving, from the *London Graphic*, represents the ice box between decks (1), the refrigerator room (2), weighing the meat (3), loading carts on the quay at Liverpool (4), and packing a meat train at the railway station (5). The meat room aboardship is lined with patent oilcloth, and also with airtight boarding; the roof is studded with iron hooks, at such distances as to keep the quarters of beef from touching each other, friction being found to damage their chances of preservation. The place is kept exquisitely clean. On the side of this chamber, opposite to the ice house, are placed wooden flues, open at the top and perpendicular to another and larger flue, which runs alongside of the chamber and crosses the floor into a wooden chest, attached to which is a fan worked from above by a donkey steam engine. The fan, when set in motion, causes a current which draws the heated air from the top of the compartment down through the wooden flues, and along that running across the floor into the chest, thence passing into the ice house, with great force, by an orifice at the top. The air becomes cold in the ice house, and this cold air, passing out of the ice house at the bottom, is sent into the meat room. The air is subjected to the same treatment again and



THE AMERICAN MEAT TRADE IN ENGLAND.

again, so that a constant current of pure cold air is being supplied by the refrigerator at a temperature of about 37°, or sufficiently cold to preserve the meat, but without freezing. When the fan is in motion the current of air is strong enough to draw into the flues any small pieces of paper thrown into the air. The door of the meat store, as well as that of the ice house, is cased with india rubber, and is fastened on with screws which make it airtight, if required. The ice house is somewhat smaller than the meat room; it is packed with block ice. The floor, being covered with coarse canvas, acts as a filter for any sediment which may gather, preventing it from passing away with the water formed by the melting ice. The ice, if allowed to go with the water, would choke the pipe connected with this part of the arrangements.

The London *Graphic* gives the following particulars as to the American meat trade in London:

"The fact that beef can be brought over from North America in good condition has therefore been abundantly proved, but the check to the further development of the trade has been that directly the meat is unloaded it must be sold and used. The simple way to meet this difficulty is, naturally enough, to unload the quarters into a wharf with a refrigerator that will continue the conditions under which they have been brought over and in which they can be kept till they are wanted in the market. The care taken both in America, and in regulating the temperature in bringing the meat over, is of but little practical value if, on its arrival in England, the meat be allowed to fall into a condition in which it is unfit for use before it reaches the consumer. But, although the remedy is so obvious and so simple, it is not until now that any plan for definite action in the matter has been proposed.

"It was Mr. D. Tallerman, Managing Director of the Australian Meat Agency, who proposed the new arrangement for the reception of foreign beef into London, based upon the adoption on a large scale of a simple principle already well known. Mr. Tallerman's plan was simply to have a large refrigerator for the reception of foreign meat, from whatever country it may come, when brought in the ice compartments, and also for fruit, game, and other perishable foods. The company, of which he is managing director, secured premises having an area of five eighths of an acre, and this, with a flooring of a portion of it, makes a total floor space of an acre. Arrangements are being made for converting this into one vast refrigerator. The building is divided into eleven arches, and by airtight doors each arch is to be a separate compartment. One compartment is arranged to contain the ice supply, and by earthenware pipes to the different compartments the temperature of each is to be regulated. A fan, worked by a two horse power engine, will draw the dry cold air from the ice chamber through the compartments. A large portion of the upper floor is fitted up with shelves, which can be used for the storage of fruit and poultry.

"When the arrangements of the company are completed the whole of the premises will be one vast refrigerator, in which during the hottest summer the temperature will not rise above 40° Fah. Passing through an ice chamber to reach the required point, the air is to be filtered through cotton wool before circulation through the storage refrigerators. These are large enough to hold the meat supply of London for a fortnight, exposed to a continuous gentle current of the coolest, purest, and driest air. An important feature in these arrangements of the London company is that the transport from Liverpool is effected without any handling after the quarters of beef leave the steamer's hold. For this purpose, Captain Acklom's refrigerating wagons and a Great Western converted van are employed. In these vehicles a low temperature is maintained by the circulation of water outside the central chamber, which is fitted with hooks. As soon as the forty-eight quarters, which one of the Acklom wagons will carry, are placed in them, the doors are closed, and the meat can then be transported any distance and in any weather without fear of deterioration. One of Acklom's wagons, containing quarters of beef just as they had come from Liverpool, was exhibited at the entrance of the New Meat Market, and excited much interest.

"In order to familiarize the public with the sale and quality of American fresh meat, some hundreds of sides of beef have been daily brought for sale to a market formed by a single arch of the company's premises in Upper Thames street, and sold to all comers; 14 cents per lb. is the average price of the whole side of beef, but fore-quarters are sold at 13 cents, while 16 cents is charged for boiling and roasting joints taken together."

Spring Fever: How Not to Have It.

In the *Christian Union*, a writer gives the symptoms and several remedies for a very common complaint, prevalent with almost every one to a greater or less extent at this season of the year:

The hampered body, says the writer, which has been coddled, petted, stuffed with carbon-bearing fats, and calorified in every possible way, begins to protest. The machinery is clogged; headache, dyspepsia, and the thousand nameless sensations of discomfort which we charge to variable weather, afflict and hamper poor humanity. To-day the fog depresses our vital force, to-morrow the brain is pierced with blinding sunshaft; and so each day's external is made responsible for internal shortcoming. The *littérateur*, in a trillious humor, afflicts the world with morbid philosophy. The pastor sees weak humanity more than ever sinful, and his Lenten homilies are unconsciously tinged with a deeper dye for the pangs of his own mortality. The housewife,

in overheated rooms, with a monotone of circumscribed care and too little outside diversion, finds dirt and despair in the kitchen, chaos in the nursery, a forlorn hope in her mending basket.

Among other remedies for people who say, "I always have a bilious attack in the spring," the following seems the most potent:

On rising, sponge the body lightly and quickly with cold water, briskly toweling after. It is not necessary that this be a long or laborious operation: the more rapidly the better, with sufficient friction to bring a glow to the skin. If you cannot secure time to go over the whole bodily surface, at least make it a point to daily sponge the trunk and arms. Rousing and stimulating the whole system, clearing and opening the pores, it imparts an indescribable freshness and exhilaration, amply repaying the effort. Rehabilitated, you are now ready for your morning bitters, namely, the clear juice of a fresh lemon in a wineglass of water, without sugar. This is a bomb straight at the enemy, for a more potent solvent of bile is not in the *materia medica*. Searching out rheumatic tendency, attacking those insidious foes which are storing up anguish against our later days—calculi—it pervades the system like a fine moral sense, rectifying incipient error. It is needful, perhaps, to begin with two lemons daily, the second at night just before retiring.

A primitive but most efficacious prescription, which corrected the physical reaction after a pork-eating winter for our ancestors, was a wineglass full of very hard cider, made effervescent by a crumb of sal soda. More potent and palatable is the concentric force of the pure lemon acid.

We venture to claim for this self-treatment alone, faithfully applied, more relief for the body and stimulus to the mind than from a battery of pills or quarts of herb decoction.

Self-Made Men.

Self-made men, in the common acceptance of the term, are those who, with but few outward opportunities, have by their own unaided energies risen to acknowledged greatness. There is some danger, however, lest in bestowing this appellation exclusively upon such persons we convey the impression that those who possess the advantages of instruction, training, and assistance, cannot be self-made. It is a truth which is sometimes overlooked that, whatever there is valuable or excellent about a man, comes primarily from his own capacity, energy, and industry. The most abundant advantage and the most generous education can never supply the lack of brains, or implant innate power, or compel untiring perseverance. If they could, there might be some justice in regarding the academy or university as the rival of self-education, and in distinguishing rigidly between the self-made man and the college-made man. As it is, every one whose life amounts to anything at all is self-made in the true sense, whether he be favored with outward helps or not. He must not only supply the foundation of a capacity to learn, but must also furnish a continual relay of power in the form of assiduous and patient labor. If he fail in this, no system of instruction, however admirable, no corps of teachers, however able, no amount of wealth, however judiciously expended, can ever avail to give him significance as a scholar. He must be self-made, if made at all, though he be surrounded from infancy with every appliance that money or affection or wisdom can suggest.

The same thing holds good of excellence in all other pursuits. If a man is to become a superior mechanic, or merchant, or physician, or artist, he must be self-made, whatever be his advantages of training or instruction. The force to overcome obstacles and the courage to face difficulty, the ability to form wise plans and the energy to execute them, the patience to wait for success, and the industry to secure it, must all come from within. Without these, it is of no avail that the boy be placed in the best mercantile house, that the apprentice be trained by the most skillful artisan, that the medical student be prepared by the most learned professors. It will all end in disappointment and failure, if he put not his own shoulder to the wheel, with a vital power that no outside influences can supply.

It would, however, be folly, for this reason, to undervalue the helps we obtain from external sources. Indeed, it is only as we assign to them their true office that we can appreciate their real worth. They cannot, it is true, make valuable men, but when rightly used, they can vastly aid men in making themselves valuable. There are but few who can rise to greatness in any branch without such aids. Occasionally a great man astonishes us by the heights to which he climbs, unsupported save by his own mental strength and powerful will. But these are exceptional characters, and might have risen to still loftier eminences had they been favored with more propitious circumstances. Most of us need all the help we can obtain—the discipline of the schools, the training of faithful instructors, the hints and suggestions of experts in our special callings, and every other outside influence that can be brought to bear upon our improvement—in order that we may attain a moderate degree of excellence. Gladly should we welcome all such assistance, eagerly grasp it, and earnestly strive to profit by it, only remembering that it can never supplant but only supplement and invigorate our own exertions. Just as the warm sun rays and refreshing rain drops descend to bless the plant that is charged with vitality, but fall powerless on one without root or sap, so outside help is invaluable to the energetic living worker, but impotent to one who lacks brains or energy, or the will to exert them.

It is especially encouraging to one who can command but few external advantages to reflect that he is by no means de-

pendent upon them for his success in life. It is true that the best results may be expected where a strong self-energy comes under wise instruction and guidance; but while the latter alone can do nothing, the former alone can do much. Besides, it never is quite alone. Capacity and industry always find appreciation and help, and are apt to make it all the more useful for its scarcity. All young persons especially can be, and should resolve to be, self-made. Whether poor or rich, whether wholly self-dependent or favored with assistance, they must evolve whatever they would become mainly from their own native abilities and enthusiastic efforts. With these in active exercise, none need despair of excellence; without them, none will attain it.—*Philadelphia Ledger*.

ASTRONOMICAL NOTES.

OBSERVATORY OF VASSAR COLLEGE.

The computations and some of the observations in the following notes are from students in the astronomical department. The times of risings and settings of planets are approximate, but sufficiently accurate to enable an ordinary observer to find the object mentioned. M. M.

Positions of Planets for May, 1877.

Mercury.

On May 1, Mercury rises at 5h. 49m. A.M., and sets at 8h. 49m. P.M. It can be easily seen in the first half of the month, especially on the 3d, when it has its best position. At that time it sets about 8° north of the point of sunset. On the 31st, Mercury rises at 4h. 23m. A.M., and sets at 6h. 23m. P.M.

Venus.

On May 1, Venus rises at 5h. 1m. A.M., and sets at 6h. 44m. P.M., too nearly with the sun to be seen. On the 31st, Venus rises at 4h. 57m. A.M., and sets at 7h. 55m. P.M. Venus may perhaps be seen after sunset at the last of the month, as it sets a little north of the sunset point.

Mars.

Mars rises on May 1 at 1h. 23m. A.M., and sets at 10h. 55m. A.M. On the 31st, Mars rises at 0h. 18m. A.M., and sets at 10h. 26m. A.M. Mars is among the stars of *Capricornus*, and, although small, is very readily known by its ruddy color.

Jupiter.

Jupiter is very brilliant in the morning. It rises on the 1st at 11h. 2m. P.M., and sets at 8h. 4m. A.M. of the next day. On the 31st, Jupiter rises at 8h. 54m. P.M., and sets at 5h. 56m. the next morning. On May 3, only three of the satellites of Jupiter will be seen when it rises, one of them being in transit across the disk of the planet. On May 5, only three satellites will be seen before midnight, the smallest being in transit across the disk. On the 21st, when Jupiter rises, only three satellites will be seen, as one of them is in the shadow of the planet, or is eclipsed. On the 25th, the largest satellite cannot be seen in the evening, being behind the planet. A good opera glass, an ordinary ship's glass, or a small telescope will show these moons of Jupiter.

Saturn.

On May 1, Saturn rises at 3h. 2m. A.M., and sets at 2h. 15m. P.M. It can scarcely be seen at all. On the 31st, Saturn rises at 1h. 9m. A.M., and sets at 0h. 27m. P.M. At this time it can be seen for a few hours in the morning. It is among the stars of *Aquarius*.

Uranus.

On May 1, Uranus rises a few minutes before noon and sets at 1h. 49m. the next morning. On the 31st, Uranus rises at 10h. A.M., and sets at 11h. 52m. P.M. It is still among the stars of *Leo*.

Sun Spots.

From March 16 to April 15 the sun has been unusually free from spots, even for this minimum period. But two groups have been seen, the first composed of two small spots, on March 18, and the second, a large group, on April 15. A peculiar interest attaches to them, however, as they seemed to appear suddenly near the middle of the sun's disk. No spots could be seen on April 14, yet on the 15th a double spot of large size, surrounded by several smaller ones, is found near the center, seeming to show a sudden disturbance in that region.

The Comet.

On the morning of April 15, the small comet, just visible to the eye, was very near the star 32 *Pegasi*, and moving slowly toward the north. It had a bright nucleus, and could be seen with a glass until just before sunrise. It is increasing in brightness. The train is broad, and up to April 15 not more than a degree in length.

Substitute for Sulphate of Quinine.

Dr. Woodworth, Supervising Surgeon-General, calls the attention of medical officers of the U. S. marine hospital service to the extraordinary increase in the market price of quinia sulphate, and at the same time to the accumulating testimony in favor of the employment of the quindia, chinchonidia, and chinchonia sulphates, of which the two first named are believed to be as efficacious as the quinia sulphate. He suggests that the less costly salts be accorded a fair trial, and that medical officers take this matter in consideration in preparing their next semi-annual requisition for medical supplies.

A. K. S. writes to say that strong draught is indispensable in a coal oil lamp, and that there exists a demand for a flat-wicked lamp with an argand chimney, which will supply the draught necessary to give perfect combustion.

NEW YORK ACADEMY OF SCIENCES.

The regular business meeting of the Academy was to have been held on Monday evening, April 2, but owing to the storm a quorum was not present and no business could be transacted. Professor Chas. A. Seeley continued his paper of the previous meeting on devices for securing pressure in filtration; after which Professor G. J. Rockwell, of the Japan University, presented a paper entitled

INDEX TO THE LITERATURE OF VANADIUM, 1801 to 1877, which was read by title, and will be published in full in the *Annals of the Academy*. This index is on the same plan as those on uranium and manganese, by Dr. H. C. Bolton, and on titanium, by E. G. Hallock, previously presented to the Society. Vanadium has recently been discovered to be one of the most useful metals, especially for the manufacture of aniline black and indelible ink. As yet the sources are few, and the amount found very minute; so that the metal sells for \$330 per ounce. Some of our New Jersey ores, however, says Dr. J. Walz, contain vanadium, and the Yankee who succeeds in extracting it on a commercial scale will confer a lasting benefit and secure a fortune at the same time. Mr. Rockwell has given in his index some 500 references, which will enable the investigator to find out with but little labor just what has already been known and written.

The Section of Chemistry held their regular meeting Monday evening, April 9, at the School of Mines, Columbia College. The first paper of the evening was by Mr. T. O'Connor Sloane, E.M., on the

EXPERIMENTAL EXAMINATION OF GAS COAL.

The speaker, who is a practical gas engineer, first described the methods of making illuminating gas from coal by dry distillation on a large scale. The subject was suitably illustrated by lantern pictures. The wet and dry meters were also exhibited, and their action explained. Mr. Sloane then described the experimental gas apparatus employed by him for determining the quantity and quality of gas that may be obtained from a given specimen of coal. The retort employed is 7 feet 4 inches long, and will hold a charge of 224 lbs. of coal. The stand pipe is 7 inches in diameter; beyond the main, the hydraulic main 3 and 4 inch pipes may be used. The usual forms of condenser, scrubber, purifier, and meter are employed. The gasholder, which has a capacity of 15,000 cubic feet, is so arranged that, when the holder is down, it will be entirely empty. It is weighed by running water into a basin formed by the top sides of the holder. By-passes are used to cut out any of the purifiers or meter if desired. Gas from the large works can also be sent through this apparatus for experiments with the condensers and purifiers. A preliminary charge is made at 7 A.M., to get all the old gas or air out of the apparatus, and is drawn at 10 or 11 A.M., when 1,100 cubic feet of gas have been run through and registered. The next charge is carefully weighed and put in, the meter reading taken, and the apparatus connected with the holder. About 5 P.M., when the gas comes off so slowly that it requires two to three minutes to make a foot of gas, the charge is drawn. Two determinations are usually made: one of maximum yield, the other of quality at standard yield. The coke is also weighed at the close of the operations. The gas ought then to be subjected to a careful and complete analysis, which is not done in any of our city gasworks, probably owing to the labor and expense, which influences the penny-wise, pound-foolish action of the directors.

The second paper of the evening was on the

DETERMINATION OF IODINE BY THE BLOWPIPE.

by Mr. Walter B. Devereux. The determination of iodine in the presence of the other halogens, chlorine and bromine, has hitherto been a difficult and uncertain operation in blowpipe analysis. Mr. Devereux takes advantage of the well known property which sulphate of copper possesses, of decomposing metallic iodides and liberating the iodine. The substance to be tested is mixed with one third its weight of pulverized sulphate of copper, and the mixture is introduced into a glass tube closed at one end and heated. The iodine is easily recognized by the violet color of its vapor, or by holding a piece of moistened starch paper at the open end of the tube, taking care that the paper does not become heated, which would destroy the blue color of the iodide of starch. This precaution is more especially necessary in the case of iodide of silver, which requires a high heat for its decomposition. At the close of Mr. Devereux's remarks, Professor Egleston spoke of the great value of this test, and expressed the hope that equally simple tests might be found for chlorine and bromine when mixed together.

The third paper of the evening, by Dr. P. de P. Ricketts, was on the

REFINING AND COINING OF GOLD AND SILVER.

Dr. Ricketts illustrated his remarks by a series of magic lantern views, showing the apparatus and machinery employed in the Government assay offices and mints. The treatment of the crude bullion with nitric and sulphuric acids was described, and the method of assaying the same referred to. The alloying of the fine bars from the parting for the manufacture of coins was explained; and the various operations of rolling, annealing, culling, milling, and cleaning the coin dies, also the stamping and adjusting of the coins, were shown by views taken from the mint in Philadelphia. The method of making the steel dies for coining and the apparatus for utilizing the waste of the mints and Assay Office was illustrated and explained, some reference being made to the European mints.

Binocular Vision Experiments.

BY FRANCIS E. NOYER.

It is possible that the phenomena here described may have been observed before, but I have been unable to find any record of them.

1. Fold a sheet of writing paper into a tube about an inch in diameter. Look through the tube at some distant object with one eye, and toward the open hand with the other eye, the edge of the hand being in contact with the tube. The dissimilar objects producing unlike images upon the retinae, the sensations blend, and a hole will appear to be cut through the palm of the hand, through which the tube passes. That part of the tube between the eye and hand will appear to be transparent, as though the hand were seen through it.

This experiment is very old, but seems not to have found its way into scientific literature.

2. Replace the hand by a sheet of unruled paper, upon which a drop of ink has been placed. By proper management, the ink blot may be made to appear within the tube, by so placing the paper that the hole, which is apparently cut through it, coincides with the blot. Ordinarily the blot will then appear opaque, the paper immediately around it, and apparently within the tube, being invisible. The blot appears as it were suspended in space. By concentrating the attention strongly on objects seen through the tube, especially if they are strongly illuminated, the blot becomes more hazy, transparent, and may even be made to disappear altogether. The mental effort necessary to do this cannot be maintained more than a few seconds, and the spot will reappear. If the effort to cause the spot to thus disappear be kept up, the attention being strained to its highest pitch, the blot will disappear and reappear at regular intervals of a few seconds, the absolute time depending upon the illumination. It seems as though the organs exerted become fatigued, and, relaxing for a few moments, refreshment sets in, which again renders possible the exertion necessary in causing the blot to disappear. It is possible that these experiments may be so made as to throw some light upon the conditions necessary in fixing the attention. Interesting experiments may also be made by substituting a fragment of a plane mirror for the sheet of paper. Looking through a rather large tube at a distant object with the right eye, the reflected image of the left eye will appear staring up the tube, the adjoining parts of the head being invisible.

3. Substituting for the ink blot a small hole cut through the paper, the small hole can also be made to appear within the tube, distinguishing itself by its different illumination, the surrounding paper being invisible, unless attention be directed too strongly to the paper in which the hole is cut. The relative illumination of the small hole, and the space immediately around it, depends upon the relative illumination of objects upon which the tube is directed, and that of the sheet of paper exposed to the other eye.

4. Keeping the same arrangement, place at a distance of one foot from the end of the tube a sheet of paper so that objects beyond it are still visible; arrange matters so that it is visible to the eye looking through the tube, but not to the other, directed at the small hole in the paper sheet. This second sheet will now appear to be traversed by a hole the same in size as that cut through sheet No. 1.

Cutting a small hole in sheet No. 2, matters are easily arranged so that it appears within the hole which was before seen within the tube. These experiments may be utilized in showing the simultaneous accommodation of the two eyes.

5. Tubes of this kind, blackened on the inside, are very convenient in studying color sensations. Using two such tubes, look through one with the right eye, say, at red, through the other with the left eye at green paper, illuminated by the direct solar ray. The color sensations fade with marvelous quickness. Transferring both eyes to either color, say red, the eye fatigued by green sees the red greatly intensified, the effect being rendered the more striking by the simultaneous impressions received by the two eyes. Experiments in the combination of color sensations will readily suggest themselves.—*American Journal of Science*.

American Industry.

A public dinner was recently given in Cincinnati to the Hon. A. T. Goshorn, Director-General of our late Centennial Exhibition. In response to the toast, "American Industry," Mr. Goshorn made an interesting speech, from which we extract as follows:

"There is loud and bitter complaint that the American people are too industrious—do not have enough holidays, and burn candles at both ends, wasting adipose tissue and the precious phosphorus of the brain. A young man hardly gets fairly into business, and learns to love it and make it go, when he is set upon by wise physicians and told that he is toiling too much, and especially enjoined not to overwork the brain. Distinguished strangers mourn over us because we are lean, and say we do not chew our food because we have not time, and that temperance fanaticism runs riot in the land until generous liquors are unpopular, and we are washed pale and cold with floods of ice water. Still, from time to time, there are to be seen in public resorts American citizens who do not overwork themselves. The heavy sitting around corner groceries, drug stores, cigar shops, and beer halls is, I think, sufficient to secure the safety of the country. Then a wire-edged person might say that this visible inertia is the surface indication of the industry of those who get their living out of politics, and so save us all.

"The new world of geography is the old world of geology. There is in our valleys and mountains written proof that

some of the six days the Lord spent in making the earth must have been measured on old-fashioned timepieces, not used in the historic period. Our illustrious ancestors in crossing the Atlantic were no doubt animated by the noble purpose of having a good time. Their medical advisers told them they wanted a change of air, and that they mustn't work too much with their brains. Life was heavy in Europe. There wasn't such a Paris then as there is now. This continent contained the fatness of the ages in its soil. Virginia was a vast park filled with the red deer. The rivers were flush with fish, the air was full of canvas-backed ducks and honey bees, the bays were paved with oysters, the soft-shelled crabs tickled the seaweed, and the point clams bored the sands, while the diamond-backed terrapin ambled away over the soft meadows. The fragrant sassafras tree gave its buds and roots to make tea delicious as the beverage of the Celestials—and in the deep woods were autumnal rains of nuts on the tinted leaves—walnuts, hickory nuts, beech nuts, and butternuts—and the pawpaws and persimmons, richer than Spanish figs, grew mellow and yellow in the white frosts, and fattened the succulent opossum—a providential preparation to soften the asperities of life for the approaching African. Talk of the hardships of the pioneers! They had a variety of sea food and forest game that would have confounded the old Romans. They lived on the cream of the universe, and licked it up to the utmost of their highly cultivated capacity.

"I do not feel that we have occasion to be always astonished at what has been accomplished, when we consider the fine continent we had here in the aboriginal package, and the endowment in capital and labor that Europe has bestowed. Let us learn to look upon the world with the understanding that the American citizen is not a being whose mission is the astonishment of the rest of mankind. The fact is, we may land at any of the European ports and stand in square-toed American boots without imparting an additional vibration to the tottering thrones.

"It is the better part of the experience of travel to be pleasantly surprised on coming home. When first contemplating America from the European standpoint, it is interesting to be asked whether you are from North or South America. They do know there are two Americas, even where they do not know the difference between Kentucky and Kansas. Returning from Europe in 1870, after attempting to identify myself in the foreign mind with North America, the popular inquiry in Cincinnati was: 'Have you seen the great Exposition?' Of course I must have seen it, wherever it was or whatever it was! The mood in which one returns from abroad is not that of being sensitive to home-made spectacles.

"When a journalist in a city of the first class, containing less than four million inhabitants, longs for the unattainable, it is likely to take in his mind's eye the form of a copy of the *London Times*. It is the expression of the highest public opinion, and therefore the best authority in England. The leading article of the *Times* of March 1 is a discussion of the importance of the representation of England at the Paris Exposition. It speaks of the superiority of the trained intelligence of the workmen of Germany and America—and so 'the competition at Philadelphia was not altogether satisfactory to us.' The fineness of the mechanical work shown at Philadelphia 'could not have been exceeded if every man who had any share in its production had originally conceived it and had been solely interested in its success.'

"It is important, then, that American industry shall be represented in Paris, so as to confirm the marvelous reputation won at Philadelphia. The fame of our Exhibition should be justified and made brilliant in the polite capital of the world. We should be represented at our best. Goshorn would be a good man, but he is from Ohio. The fact that the President, Chief Justice, General, and Lieutenant-General of the United States are from Ohio, and that their predecessors in those offices were Ohioans, seems to the country at large a shade too much for one State. We are modest: we have the 'reserve,' though Mr. Evarts cannot see it; but what can we do? True, we must draw the line somewhere on our embarrassing superabundance of talent.

"The Thunderer of London is right. There are brains in American industry. Why, the great Corliss engine at the Centennial Exhibition had brains, for I saw it pick up its own valves and drop them when there was just steam enough on, and very few men can be trusted to do that. It had so much sense it would not waste 1 lb. of steam, for it knew that steam cost money. American brains shine in the finish and fitness of the work that is commanding even the markets of Asia. It is the busy brain behind the cunning hand that guides the great artisan to perfect his workmanship, just as the colors of the artist must be mixed with brains if they are to be radiant for ever. And yet American industry has been struggling under the disadvantage arising from political disturbances and financial disorder. We must endeavor to remove our professional politics from the pathway of intelligent industry. There is a chance for strokes of statesmanship.

"One virtue in which the Americans are not conspicuous, they need to complete the round of their triumphs. It is thrift. The growth of two blades of grass or two stalks of grain where there was one should be celebrated. Cutting down trees was the beginning of our industry. The time has come to plant trees, and to cover the fields with clover to bind up the wounds of the soil—to restore to the fire-swept deserts the blooming wilderness, tempting the gentle rains from heaven that the waste places may be fruitful, that the rivers may not run turbid with the riches of the earth to the seas, and that the great continent we inherit may be good for the generations to come."

Inventions Patented in England by Americans.

From March 26 to March 29, 1877, inclusive.

ANIMAL TRAP.—J. Martin, Palestine, Texas.
 BRUSH.—H. Rosenthal, New York city.
 FRICTION COUPLING.—T. A. Weston, Stamford, Conn.
 FURNACE, ETC.—R. L. Walker, Boston, Mass.
 HORSESHOE MACHINE.—J. A. Burden, Troy, N. Y.
 KNITTING MACHINE.—W. H. Abel, Laconia, N. H.
 LAMP.—L. B. Olmsted, Brooklyn, N. Y.
 MAKING STEEL, ETC.—C. M. Nes, York, Pa.
 RATCHET CLUTCH.—T. A. Weston, Stamford, Conn.
 REFRIGERATOR, ETC.—J. Tiffany et al., Chicago, Ill.
 SCREW-LIFTING JACK.—J. O. Joyce, Dayton, Ohio.
 STOVE.—J. K. Dimmick et al., Cincinnati, Ohio.
 VEHICLE WHEEL.—J. B. Sammis et al., New York city.
 WHEEL SKATE.—C. W. Saladeo, Wolcottville, Conn.

Recent American and Foreign Patents.

NEW MISCELLANEOUS INVENTIONS.

IMPROVED CARD RACK.

James P. Lamoree, Canandaigua, N. Y.—This card rack is formed of a series of clamping strips or slats, connected in step shape at their thicker ends, so that the thinner spring ends extend one beyond the other, and form spaces for the storing of the cards.

IMPROVED CHECK-REIN SPREAD AND ATTACHMENT.

Daniel Schoonmaker, Newark, N. J.—This consists of a rein-spread formed in one piece, of cast metal, which is attached to the ends of the check-rein straps, or is provided with loops running transversely to its body, in which case the strap may be continuous from one end of the bit to the other, simply passing through the loop of the spread. The spread is of such form as to be readily placed on, or removed from, the water-hook. The device further consists in a bolt having a head of peculiar form, to be applied to the saddle, to be used in place of the usual water-hook, in connection with the rein-spread.

IMPROVED ADJUSTABLE HAT.

I. Ygnacio Cassiano, San Antonio, Tex.—The present invention is an improvement upon a former patent granted to same inventor December 2, 1873; and the object of the same is to furnish sectional bands for hats, so constructed as to leave the forehead of the wearer free, and so that the band may be adjusted to a larger or smaller head, and to fit closer or looser, as may be required, or, if desired, to cover the whole or part of the forehead.

IMPROVED THILL COUPLING.

Thomas B. Farrell and Martin D. Borst, Cobleskill, N. Y.—This consists of a fork or yoke for receiving the thill irons, that fits into a socket attached to the axle by means of a clip. The said fork is provided with a rubber spring, that presses against the thill iron, and abuts upon a plate that rests against the socket. A nut is provided at the rear end of the fork, for drawing it into the socket and tightening the rubber spring.

IMPROVED SHACKLE FOR CONVICTS.

Jay L. Quackenbush, Portland, Oregon.—This invention consists in the combination of hidden screws with the semi-cylindrical jaws of the half-ring parts of the shackle, having a screw thread cut upon their outer surface, and caps having a screw thread cut upon their inner surface. The key may be made with a fork to enter holes in the heads of the screws.

IMPROVED BALE TIE.

Joseph H. Fisher, Chicago, Ill.—This consists in a buckle of peculiar construction, adapted to a metallic strap to which it is attached. A lever engages projections on the sides of the said buckle, and there is a hooked pawl for engaging holes in the bale band.

IMPROVED PHOTOGRAPHIC PLATE HOLDER.

Charles L. Kempf, Brooklyn, N. Y.—This is an improved holder for photographic plates, so constructed as to enable the solution to be saved, and at the same time to protect the said frame from being destroyed by the solution. The double reversible corners are provided with a rabbet along their inclined edges, a groove along their lower flange, and other arrangements to adapt them to receive and carry off the solution. Tubes pass through the angles, and there is a curved solution bottle, provided with a mouth at each end, in combination with the recessed bottom bar of the frame, and with the two corners.

IMPROVED FIRE ESCAPE.

Tobias Lyness and Joseph P. Dunne, New York city.—This consists of a crosspiece with spurred end cheeks, placed across the inside of a window casing, and having a rope ladder suspended from adjustable eyes. The rounds of the rope ladder are provided at the ends with brackets, and that part of the ladder which passes over the lower window is arranged with one or more crosspieces in place of the brackets. In case of fire, the main crosspiece is placed across the window casing, and the rope ladder, with the lower crosspieces, lowered from the window, after which the fire escape is ready for use.

IMPROVED CARTRIDGE-LOADING IMPLEMENT.

James H. Dudley, Poughkeepsie, N. Y.—This instrument may be used as a rammer for loading, capping, removing an exploded cap, or for withdrawing a cartridge shell from a gun barrel, or the paper cylinder of a cartridge from a gun barrel should the metallic base-piece pull off. It may also be used for grooving a cartridge shell to prevent the charge from dropping out.

IMPROVED THILL COUPLING.

James F. Hill, Fleetwood, Pa.—This is an improved thill coupling, by which the shafts may be readily shifted from one carriage to another. The invention consists of a shaft box or bearing, with hinged top attached by a clip to the axle. The center pin of the shaft attachment turns in the box, and is retained therein by a locking lever mechanism, that binds on a tongue of the cap.

IMPROVED BAG FASTENER.

Henry Redden, New York city, assignor to Andrew M. Underhill, of same place.—The object of this invention is to improve the construction of the bag for which letters patent were granted to same inventor May 23, 1876, in such a way that its contents may be discharged readily and quickly, and which, when tied, will prevent any leakage. When the bag has been filled, the outer edges of two flaps are brought together, and the said flaps are rolled together within the mouth of the bag. The mouth of the bag is then drawn together over the flaps by cords. The apron is fastened on the inside near inner edge of hem, while the cord runs parallel to the hem, to allow the bag to be fastened quickly without sewing, and opened without cutting.

IMPROVED CHAIR SEAT AND BACK.

Paul Rath, New York city.—The bottom of this chair seat is made preferably of a piece of pasteboard which is stamped by suitable machinery, so as to form a central opening; and a concave moulding, of suitable depth, extending around the opening. The sides of the pasteboard are turned down to form flanges by which the seat or back may be attached to the piece of furniture. The pasteboard is covered at both sides with canvas or other fabric, that passes across the center opening, so as to close the same and provide a flexible base for the seat. When the bottom is thus finished it is exposed, with a quantity of wadding or other stuffing, and with a loose leather or other covering, to the pressure of a powerful hydraulic or other press, by which the bulk of the wadding is reduced to smaller compass, and sufficient elasticity given to the same to furnish a soft and flexible seat.

IMPROVED NECKTIE.

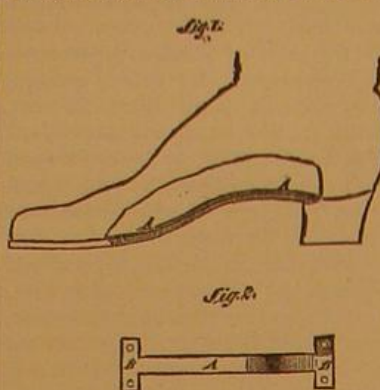
Robert Swenarton, Newtown, N. Y.—This consists of a slotted plate for receiving the collar button, which is provided with a barb or projecting point at each side for engaging the ends of the band that encircles the neck. The object of this invention is to provide a necktie that may be securely fastened, so that it cannot become accidentally loosened, and which is capable of being worn either with or without a band to encircle the neck.

IMPROVED BUCKLE.

Benjamin F. Melton, Gainesville, Tex.—This consists of a buckle with fixed loop extending at the under side from the lateral tongue bar of the buckle. It may be manufactured quicker and cheaper than when the loop has to be sewed with the buckle to the strap end.

IMPROVED SHANK SUPPORT FOR BOOTS AND SHOES.

George W. Wells, Black Hawk, Col.—The invention illustrated herewith is an improved spring for the soles of boots and shoes, so constructed as to prevent the soles from twisting or getting otherwise out of shape, while giving great elasticity.



A is the spring, which is made of steel, and of such a length as to extend from the heel to, or nearly to, the ball of the foot, and which is bent to give the desired arch to the sole. The spring, A, is made with a cross-head, B, at each end, as shown in Fig. 2. Through the ends of the cross-heads, B, are formed holes, to receive rivets for securing the said spring to the insole of the boot or shoe. The rivets have wide flat heads, to give them a firm hold upon the insole, and prevent them from hurting the feet of the wearer. This construction gives the springs great strength to recover themselves from a lateral twist or strain, and at the same time gives to the sole elasticity in walking. The inventor, who may be addressed as above, desires to contract for the manufacture of this device.

IMPROVED MODE OF EXTINGUISHING FIRE, ETC.

Donald McLennan, West Green, assignor of one half his right to Mary Ann Davis, London, England.—This is an improvement in means for extinguishing fires by discharging water from stationary perforated tubes attached to the walls or ceilings of rooms, halls, etc., of buildings. The improvement relates particularly to the construction and arrangement of devices for turning on and shutting off water in the several rooms in which the perforated tubes are located. Each cock is operated by a connecting rod, elbow lever, and a pull rod. The several pull rods are arranged together, and extend downward by the side of the wall of the building, and are provided with suitable handles. By pulling any one or more of the rods, the water will be let on in the corresponding room or rooms.

IMPROVED TRUNK CATCH.

Eliakim Rice, Cazenovia, N. Y.—This consists of a trunk catch made of three castings, provided with a spring, and capable of being put together without special fitting. It is so constructed that two dowels cast on the portion attached to the cover enter sockets formed in the part attached to the body of the trunk. The whole is arranged so that the parts may engage automatically, and may be readily disengaged.

IMPROVED SMOKING PIPE.

Bengt A. Jonasson, Warren, Pa.—This is a folding smoking pipe whose joint consists of two rabbeted hollow half-spheres and an open ring spring retainer. With this construction the mouthpiece can be turned down beneath the base, and the pipe thus reduced to small compass.

IMPROVED WIRE FENCE.

Charles D. Johnson and Levi F. Johnston, Marshalltown, Iowa.—The post is made semi-circular in cross section, and slotted to adapt it for attachment of staples for supporting the wires. This form of post secures the desired combination of strength, lightness, and cheapness. The staples are formed of short lengths of wire whose ends are twisted together and project from the post, thus forming barbs which prevent cattle rubbing against the post.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED DUMPING WAGON.

Robert A. Reed, Hoboken, N. J.—This is an improved device for attachment to the frames or bodies of trucks, wagons, cars, etc., to facilitate their loading and unloading. The general construction is such that by operating a lever the forward end of the load is raised, so that it will readily slide off. When the load is arranged to be carried, swiveled crank screws are turned to force a crossbar down upon the load, and thus bind it in place.

IMPROVED SASH BALANCE.

Adam Kolb and Charles Osberghaus, Sandusky, O.—This invention consists in combining, with pulleys, cord, and spring clutch, a rod pivoted to the clutch, and passing through a hole in the casting. The operation is as follows: When the bolt is withdrawn the lower sash may be moved upward, when the upper sash will move downward, the two sashes counterbalancing each other. If it is desired to lower the upper sash without raising the lower one, the free end of the connecting cord is drawn outward, thus drawing the clutch away from the cord by means of a rod. The cord is, at the same time, permitted to pass through an eye and between the pulleys, allowing the sash to drop.

IMPROVED SASH FASTENER.

Henry Jones, East Saginaw, Mich.—This consists of a bearing piece, supported in a casting mortised into the window sash, and which is made to press with more or less force against the casing, according to the weight of the sash, by an adjustable volute spring. The device is capable of being locked by turning a button against the bearing piece when it has dropped into a notch provided in the casing for that purpose.

IMPROVED SKY-LIGHT BAR.

Joseph Henry, Chicago, Ill., assignor to himself and R. Philip Gormully, of same place.—This consists of a sky-light bar formed with two gutters and two glass supports at both sides of the double center part, to which the glass supports are concaved for receiving the putty, while the double gutter forms an interior gutter for any leak-moisture of the bolts.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED WINDMILL.

Elias Stata, Cape Vincent, N. Y., assignor to Mary E. Stata, of same place.—This consists in the combination of a hoop or shield and a governor with a vertical windmill, in such a way that the action of the governor applies a portion of the power of the mill to raise the said shield, exposing more or less of the wheel to the action of the wind, thus controlling its motion.

IMPROVED SPIKE EXTRACTOR.

John A. Powell, California, Pa., assignor to himself and Jos. B. Crow, of same place.—This machine pulls the spikes without bending them, and is so constructed as to allow the operator to always stand within the track, so that the instrument can be used in cuts and tunnels. The arms of a clamp are pivoted to each other in such a position that their jaws may be opened enough to receive and grasp the head of a spike, which is then drawn by bearing down upon the free end of a lever.

IMPROVED CAR COUPLING.

George W. Gombert, Sybertsville, Pa.—This coupling enables the cars to be coupled and uncoupled from their tops or sides, and have sufficient play to prevent binding when the cars pass around curves. By operating a lever to press a rod downward, bars will be pressed against the inner end of the link so as to raise the outer end of said link and drop it over the hook of the adjacent car. In the same way the link may be raised to uncouple the cars.

IMPROVED CAKE MACHINE.

Daniel M. Holmes, New York city, assignor to J. Cutler Fuller, Orange, N. J., and Martha G. Holmes, New York city.—The object of this invention is to improve the construction of the machine for making cakes—such as jumbles, kisses, drops, macaroons, etc.—of soft dough, for which letters patent were issued to same inventor February 29, 1876. The invention consists in the combination of movable plungers with the hollow cutters, the cutter plate, and the dough box of a cake machine. The plungers serve to cut out the dough in suitable shapes. The machine contains considerable mechanism both novel and ingenious.

IMPROVED ROD COUPLING.

William C. McClintock, Hooperston, Ill., assignor to himself and William B. Steele, Bernhart's Mills, Pa.—This consists in a rod or shaft having scarfed ends, upon which are formed alternate transverse recesses and projections, which are so proportioned that the projections of one section of shaft fit the recesses in the adjacent section. The adjoining ends of the sections are held together by a sliding sleeve, which is retained in place by a spring latch. The device is applicable to pumpsucker rods, and to shafts.

IMPROVED LIFTING JACK.

Abram R. Hurst, Mechanicsburg, Pa.—This invention relates to an improvement in lifting jacks designed with a view to simplicity, ease of adjustment, and compactness of folding; and it consists in a stationary standard having a lift bar provided with laterally projecting teeth or pins, and arranged in guides or keepers to slide longitudinally upon the standard, in combination with a lever pivoted to the standard and having an oblong or elliptical camhead which is provided with a laterally projecting flange adapted to engage with the teeth of the lift bar to elevate the same, or to be disengaged therefrom.

IMPROVED DEVICE FOR THROWING BELTS ON PULLEYS.

Robert Reinhard, Langendreer, Prussia.—The object of this invention is to provide a simple, cheap, and efficient device for applying broad or tightly stretched bands or belts to pulleys, and thereby avoiding the difficulty and danger incident to such operation when effected by hand in the usual way. The device consists of a spring clamp for holding the belt, and a screw clamp for attaching it to a pulley. The spring clamp projects radially at one side of the pulley rim, and the screw clamp is applied directly to one of the pulley spokes.

IMPROVED WATER ELEVATOR.

Christian E. Lykke, Grand Island, Neb.—This improvement relates particularly to the form of the buckets, the construction of the chain whereby alternate links may be readily detached or separated to facilitate the attachment and removal of the buckets; also to the provision of fixed rollers journaled in a frame set in the well and serving to keep the chain distended; also to the use of a weighted stand or platform placed in the well to hold the chain taut.

IMPROVED DEVICE FOR BALANCING FLYWHEELS, PULLEYS, ETC.

Charles Seymour, Defiance, O.—The pulley to be balanced is supported horizontally upon a vertical spindle having a yoke provided with arms which engage the spokes of the pulley, so that when the spindle is rotated the pulley partakes of its motion and assumes an inclination to the horizon corresponding to the extent to which one side overweighs the other. Weights are then attached to the lighter side to make the pulley assume a horizontal position.

NEW AGRICULTURAL INVENTIONS.

IMPROVED HOG TRAP.

Elijah K. Jenkins, Elkhorn Grove, Ill.—This is an improved trap for catching and holding hogs while ringing, castrating, and marking them; and the invention consists in the combination of hinged doors, connecting bars, spring, swinging gate, bent lever, and strap with the pen. In using the trap, the hogs, one at a time, are driven into the open rear end of the pen, and, seeking to pass through it, they push back the doors by forcing their heads through between them, which doors immediately close behind their ears, so that they cannot withdraw their heads, while the gate prevents them from passing any further, and they are thus held securely.

IMPROVED COCKLE SEPARATOR.

Hermann Kurth, Milwaukee, Wis.—This machine belongs to that class of separators in which a revolving cylinder, having indented inner cavities, is made to catch the small impurities, such as cockle, foreign seed, dirt, etc., and to deliver them to a trough or pan which separates and carries them out of the cylinder apart from the clean grain. The main features of the improvement consist: First, in locating above the main indented cylinder one or more indented cylinders whose cavities or indentations are larger than those of the lower cylinder, the same being designed to separate the large wheat from the small wheat and impurities, and to take the place of sieves ordinarily employed for this purpose. Secondly, in constructing the cylinder with both indentations or cavities and perforations, which perforations are separate from and independent of the cavities and serve to effect the preliminary separation of the fine seed and dirt. Thirdly, in arranging the cylinders with one end free from, and the other end attached to, the central shaft, so as to work a conveyor and deliver cockle, etc., at opposite end of the cylinder from clean grain. Fourthly, improved construction of catch board, made automatically adjustable through hinges and provided with an adjustable flexible strip for removing cockle and impurities from cavities of cylinder and delivering them to trough. Fifthly, in the improved arrangement of the metal of the cylinder in forming the cavity, designed to increase the durability of the said cylinder.

IMPROVED GRAIN RINDER.

Harvey Hull, West Exeter, N. Y.—This is a novel construction of grain binder, belonging to that class in which the sheaf is bound with a cord which is tied in a single bow knot. It consists generally in a set of pincers which, in tying the knot, operate somewhat after the manner of the human fingers. Prominent among its novel features is an arrangement for looping and holding the cord around the tying pincers in such a manner that the loop will not slip off while the knot is being tied, but will slip off after the knot is tied; the leading device being a spring catch which, operating simultaneously with the tying pincers, projects laterally from the pincers outside of the loop while the loop is being formed, but which recedes when the pincers close, to pull the cord through the loop, and thus permits the loop to slip off. Among other important features, also, is a spring arm for holding the cord while the knot is being tied, and a hook for drawing the knot well down to the bundle.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion. If the Notice exceeds four lines, One Dollar and a Half per line will be charged.

Glass Cylinders Tempered in Oil. T. Degnan, 129 Milk St., Boston, Mass.

Wanted.—The address of the proprietor and manufacturer of the Counts Fruit Gatherer. Reply to J. C. Strubling, Pendleton, S. C.

Diamond Drills, J. Dickinson, 64 Nassau St., N. Y.

Practical Plumbers wanted as Agents for Improved Hydraulic Engine (highest Centennial award) for blowing organs. Address H. L. Roosevelt, Church Organs, New York.

Steam Yachts for sale, new, 14 feet long, 4 feet beam, 1/2 h. p., \$200; 18 feet long, 4 1/2 feet beam, 1 h. p., \$350; 21 feet long, 5 1/2 feet beam, 2 h. p., \$425. Shipping weights 450, 600, and 1,200 lbs. Will carry comfortably 4, 8, and 12 persons. Send for particulars. S. C. Forsyth & Co., Manchester, N. H.

Manufacturers can buy or lease Hydraulic Power in any quantity, at very low rates, at Rock Falls, Ill. A. P. Smith.

One hundred Salesmen are employed in the Retail Warehouses of Baldwin the Clothier. The branch house in Brooklyn holds there the same relative place that the Broadway and Canal street headquarters hold in New York. The sales are three times larger than any other house can show, and the stock displayed four times greater. The leader of the retail clothing trade is Baldwin the Clothier.

Easy Flowing Silver on Hard Solder and small Metal Tubing. John Holland, Cincinnati, O.

Capital wanted by A. Danl, 303 Morris Ave., Newark, N. J., for Postage Stamp Cancellation and Horse Car and Omnibus Control.

Wanted.—Proposals to make about 10 Tons Engine Castings, large and small. Address Box 2132, N. Y. city.

600 New and Second-hand Portable and Stationary Engines and Boilers, Saw Mills, Wood Working Machines, Grist Mills, Lathes, Planers, Machine Tools, Yachts and Yacht Engines, Water Wheels, Steam Pumps, etc., etc., fully described in our No. 11 list, with prices annexed. Send stamp for copy, stating fully just what is wanted. Forsyth & Co., Machine dealers, Manchester, N. H.

New Lathe Attachments, such as Gear Cutting, Tap and Spline Slotting. W. P. Hopkins, Lawrence, Mass.

Amateur Photographic Apparatus, Chemicals, etc. Complete outfits, \$5 to \$25. E. Sackmann & Co., manufs., Brooklyn, N. Y.

Painters.—Send for new prices of Metallic Graining Tools, for "wiping out." J. J. Callow, Cleveland, O.

For Sale.—Combined Punch and Shears, and Engine Lathes, new and second-hand. Address Lambertville Iron Works, Lambertville, N. J.

Gas lighting by Electricity, applied to public and private buildings. For the best system, address A. L. Bogart, 702 Broadway, N. Y.

Power & Foot Presses, Ferracute Co., Bridgeton, N. J.

Superior Lace Leather, all sizes, cheap. Hooks and Couplings for flat and round Belts. Send for catalogue. C. W. Army, 148 North 3d St., Philadelphia, Pa.

F. C. Beach & Co., makers of the Tom Thumb Telegraph and other electrical machines, have removed to 530 Water St., N. Y.

For Best Presses, Dies, and Fruit Can Tools, Bliss & Williams, cor. of Plymouth and Jay Sts., Brooklyn, N. Y.

Lead Pipe, Sheet Lead, Bar Lead, and Gas Pipe. Send for prices. Bailey, Farrel & Co., Pittsburgh, Pa.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing metals. E. Lyon & Co., 470 Grand St., N. Y.

Solid Emery Vulcanite Wheels.—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 33 Park Row, N. Y.

Consumption Cured.—An old physician retired from active practice, having had placed in his hands by an East Indian missionary the formula of a simple vegetable remedy for the speedy and permanent cure for Consumption, Bronchitis, Catarrh, Asthma, and all Throat and Lung affections, also a positive and radical cure for Nervous Debility and all nervous complaints, after having thoroughly tested its wonderful curative powers in thousands of cases, feels it his duty to make it known to his suffering fellows. Actuated by this motive, and a conscientious desire to relieve human suffering, he will send, free of charge to all who desire it, this recipe, with full directions for preparing and successfully using. Sent by return mail by addressing with stamp, naming this paper, Dr. J. C. Stone, 32 North Fifth Street, Philadelphia, Pa.

Steel Castings from one lb. to five thousand lbs. Invaluable for strength and durability. Circulars free. Pittsburgh Steel Casting Co., Pittsburgh, Pa.

For Solid Wrought Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

Wanted.—A first-class Wood Engraver. Address Engraver, P. O. Box 271, Cincinnati, O.

Wanted.—A first-class Mould Maker on Undertakers' Hardware. Address Mould Maker, P. O. Box 367, Cincinnati, O.

Shingle Heading, and Stave Machine. See advertisement of Trevor & Co., Lockport, N. Y.

See Boul's Paneling, Moulding, and Dovetailing Machine at Centennial, B. 5-35. Send for pamphlet and sample of work. B. C. Mach'y Co., Battle Creek, Mich.

Patent Scroll and Band Saws. Best and cheapest in use. Cordesman, Egan & Co., Cincinnati, O.

The Zero Refrigerator was awarded a grand Centennial medal. Send for book. Lesley, 226 W. 23d St., N. Y.

Esterich's Screw Cutting Tools are in great demand. Catalogue free. Frasse & Co., 62 Chatham St., N. Y.

Hyatt & Co.'s Varnishes and Japans, as to price, color, purity, and durability, are cheap by comparison than any others extant. 246 Grand st., N. Y. Factory, Newark, N. J. Send for circular and descriptive price list.

Best Glass Oilers. Gody & Rathven, Cincinnati, O.

Notes & Queries.

W. Z.'s query as to the stick of timber is a schoolboy's problem.—W. A. M. will find directions for making liquid glass on p. 225, vol. 23.—A. D. should advertise his query as to the high speed engine at the Centennial.—C. A. H. will find directions for making battery carbons on p. 197, vol. 32. We cannot recommend particular machine makers in these columns.—J. T. K. will find a description of an incubator on p. 273, vol. 33.—J. F. will find directions for making yeast on p. 185, vol. 30.—L. A. K. will find directions for bluing gun barrels on p. 123, vol. 31. For giving a fine brown color to gun barrels, see p. 11, vol. 32.—F. D. will find a good recipe for tooth powder on p. 72, vol. 34.—F. H. B. W. H. C. will find on p. 154, vol. 34, directions for tinning iron castings. As to polishing metals, see p. 57, vol. 34.—J. L. K. will find directions for making mirrors on p. 207, vol. 31.—E. F. W. is informed that the art of graining is too complicated for description in these columns.—A. L. B.'s query as to postage stamps was answered on p. 203, vol. 36.—A. R. D.'s queries are business questions, and should appear in our advertising columns.

(1) W. E. W. asks: Can sheets of spring steel be rolled out to 1/2 of an inch thick, 4 feet wide, and 21 feet long, without flaws? A. Yes.

(2) D. D. asks: How much clearance should a 12 x 20 inch steam engine of good design, running 120 revolutions per minute, have between the piston head and cylinder head? A. About 1/8 inch.

(3) M. G. says: 1. I have an apparatus for calcium light, with which I have some trouble. My reflector is 18 inches in diameter and about 11 inches deep, and set the lamp how I please, I never get a plain, brightly illuminated surface. The whole surface is covered with black and white rings, in the center of which is a large black spot. As soon as I set the lamp in a different way, the black spot disappears and in its place comes an intense bright one, surrounded by darkness. A. Clean, dry, and polish the reflector, and adjust the jet, with its lime cylinder, facing directly into the reflector so as to concentrate all the light upon its surface. For ordinary purposes the ignited surface of the lime should be within about 2 inches of the back of the reflector. Turn on first a good supply of hydrogen (or coal gas) so as to give a flame of about 6 inches length; then immediately turn on the oxygen, and adjust the supply of gases so that neither will be in excess. If too much hydrogen is on, the flame will flare out around the sides of the lime; if too much oxygen, it will either make a singing noise or extinguish the light. A little practice will soon teach you when the adjustment is perfect. The lime cylinder should be within about the 16th of an inch of the tip of the jet, and should be turned occasionally so as to present fresh surfaces to the flame. 2. Which is better for the light, common lime or the prepared lime cylinders, and what do the latter contain, that make them preferable? A. Almost any kind of good fresh lime will answer; but the best results are of course obtained with lime that is pure—free from sand and earthy materials—well burnt, perfectly dry, and caustic. The prepared cylinders of lime are usually made of the finest and hardest quality of lime, and therefore generally give the best results. The cylinders are best small. 3. Which are better, gas bags, or the copper tanks into which the gas must be pumped? A. The greater the pressure of gas, the better the light within certain limits. Wrought iron cylinders, containing the gases under a pressure of about 15 or 16 atmospheres (225 or 240 lbs. to the inch), are safest and best. Gas bags, when used as reservoirs, should have a total weight put on them of about 500 or 600 lbs. 4. Which is preferable for tinting effects, gelatin plates or colored glass panes? A. Use plates of colored glass.

(4) W. H. R. says, as to snakes catching fish: During the summer of 1872 or 1873, I was residing in Marriottsville, Md. One day we took a small net about 10 feet long and went to the stream that divides Howard and Carroll counties, for the purpose of catching fish. On one of the hauls, we succeeded in catching about a dozen minnows, about 3 inches long, and a water snake, about 2 feet long. Immediately after raising the net out of the water, the snake glided over the netting to one of the fish and swallowed it down without any apparent difficulty. As we did not appreciate his efforts in that line, we threw him on the land and stopped his fishing career with a stick. My brother told me that he once saw a snake swimming in a deep pool just below Marriottsville with a trout in his mouth about 10 inches long.

(5) S. says, as to patterns for fret saw work: I have been using a sheet of thin zinc between my pieces of wood; and by sawing out the patterns pasted on one piece of wood, I obtain a stencil with which any number of patterns can be rapidly made. The stencil will not wear out.

(6) B. G. S. asks: If two boilers having connection only by a feed pipe have different pressures, what would happen if I open the feed pipe? I think that the water will run from the higher pressure boiler till the pressure is equal, and then the water will come to the same level in both boilers. Am I right? I had four boilers, and two others set about 6 feet above the four, 45 feet long with two 15 inch flues, connected with the coal boilers at the middle and at the end, the connections being set on two steam drums across the boilers. The coal boilers were under 75 lbs. pressure; and having too much steam, I went to open the connecting valve, I felt a strong push ahead by the boilers, enough to crack the walls in two or three places. Can you explain this? A. The steam as it escaped from the boiler, having the higher pressure, acted precisely as it does in the reaction engine, and moved the boiler slightly.

(7) F. H. B. asks: Please tell me how to find the area of a circle in square inches? A. Square the diameter in inches, and multiply by 0.7854.

(8) D. H. M. asks: What is sisal? A. Sisal is the prepared fiber of the agave Americana, or American aloe; so called from Sisal, a port in Yucatan. The fiber is white, and of nearly the same thickness through-

out its great length of 7 to 30 inches. The fibers are used, in the rough state, for cordage.

(9) G. W. H. says: The specific gravity of wrought and cast iron, as given by various authorities, varies considerably. Why is this? A. It is scarcely possible to obtain pure iron. The metal ordinarily known as iron is virtually a combination of the elements iron and carbon. According to the amount of carbon present, the metal is called wrought iron, steel, malleable iron, and cast or pig iron. The specific gravity of electro-deposited iron is 7.8139; that of steel bars and plates averages 7.823; that of tilted or hammered iron bars and forgings ranges from 7.76 to 7.798; that of rolled iron plates or bars varies between 7.76 and 7.84. The specific gravity of cast iron ranges between 6.85 and 7.35; that used in construction averaging 7.1. Wrought iron is very bad in quality when its specific gravity is less than 7.5.

(10) W. H. W. K. asks: Is there any work that will instruct me how to erect a building that will answer as a kind of refrigerator without the use of ice, that will lower the temperature inside to one half of what it is outside? A. We do not know of any. 2. Have you any drawings of the Alden process of drying? A. No.

(11) E. W. H. asks: Can you give me directions for stamping cashmere, broadcloth, etc., in patterns, that will stay on long enough to have the pattern worked in embroidery? A. Try the following: Prepared chalk, 5 parts; dextrin, 1 part. Rub into a paste of the proper consistence with a strong, hot solution of soap and a few drops of glycerin.

(12) C. R. asks: What is a reliable test for pure gold? A. One of the most reliable tests for the purity of gold is its specific gravity (19.34). It should retain its luster at all temperatures and resist the action of hot nitric acid. Take a clean piece of slate, make a mark or streak on it with the piece of metal to be examined, note the appearance of this with a strong magnifying glass; heat the slate over a gas burner and note if any change has occurred. If not, moisten it with a drop of strong nitric acid free from chlorine. If this does not affect it, and its specific gravity equals 19.34 or 19.4, it may be considered pure gold.

(13) R. T. L. asks: How can I remove varnish and paint from window glass? A. Remove as much as you can with a suitable scraper, and rub off the remainder with a cloth saturated with strong ammonia water.

(14) B. asks: What is the least amount of mercury that will unite with 1 oz. of pure gold, forming an amalgam, so that no free gold will remain? A. The proportion should be about 33 parts mercury to 57 gold.

(15) J. M. asks: Please give a recipe for softening muskrat skins. I have dried a dozen of them by putting alum and salt on them, but they are too hard. A. The skins should be thoroughly washed in clean water and treated with the alum bath and albumen mentioned in answer to C. C. F., p. 251, vol. 36.

(16) J. R. M., Jr., asks: What is the simplest way to obtain iridized glass? Is it 100 parts of water to 15 of acid, and how can I obtain the required pressure of from 2 to 3 atmospheres? A. Make a solution consisting of 15 parts of strong hydrochloric acid and 85 of pure water. Place this in a glass vessel in a strong metallic receiver capable of standing a pressure of 100 lbs. to the inch. Close all the openings airtight, and pump in air until the pressure gauge with which the receiver must be provided indicates about 50 lbs. Then allow to stand for several days. You will succeed best with soft glass.

(17) W. G. asks: Can kerosene oil be adulterated with water? During the winter I bought a lot of kerosene oil and put it into my oil safe; and in a few days I was unable to draw any oil, and upon examination I found that the pipe was frozen full of ice. I cleared it, but in a few days it was again stopped with ice, which made me suspicious that the oil was adulterated with water, as I never knew oil to freeze solid. A. No. Kerosene oil and water are not miscible. The water must have got into the tank in some other way.

(18) J. R. McC. says: A brass moulder told me that he had a lot of old brass given him to remelt. It was a very hard composition, and he was asked if he could make it softer without adding any more copper; he said he could not; one of his men said he could, and he did. He was watched, but no one saw how he did it. Can you explain? A. He probably melted the brass and kept it at a very high heat, so that part of the tin and zinc evaporated.

(19) J. J. W. says: 1. In a recent issue of the SCIENTIFIC AMERICAN I noticed an article which stated that coal oil reproduced a full growth of hair on the head of an old servant who had become bald. Is it true? A. We think it is very doubtful. 2. Is there any injurious ingredient in coal oil? A. Yes. 3. Can you tell me of a simple preparation that will prevent the hair from falling out, or one that will make hair grow on a bald head? A. See answer to N. R. on p. 251, vol. 36. As a general rule, hair cannot be made to grow again on a bald head, especially if the baldness is due to the natural infirmity of advanced age.

(20) A. C. asks: How are indelible pencils made? A. Reduce nitrate of silver to an impalpable powder, add just enough lampblack to give it a black color, and enough of a thick solution of gum arabic in hot water to make the powder coherent. Rub these ingredients well together, form into thin sticks, and dry.

What is moulders' wax composed of? A. Stearin or paraffin.

(21) R. P. P. says: This morning I send a small bottle of grape wine, which soured on my hands. It is well sugared, and on exposure to the air will evaporate to a thick syrup. How can I redeem it, so that it will be fit to use as a beverage? A. Treat it with enough bicarbonate of soda to neutralize the acetic acid. The proper quantity of the carbonate may be ascertained by first experimenting with a small sample of the wine. Judging from the sample of wine you send us, however, we think it doubtful that you will succeed in rendering it again palatable by this or any other

means, as the second fermentation has been permitted to go so far that a great part of the alcohol has been acetified. If the wine be treated with enough slaked lime to neutralize the free acid, and then distilled, the spirituous constituents may be recovered and utilized.

(22) Mrs. P. R. V. S. asks: How is glycerin made? A. The greater part of the pure glycerin is obtained by distilling with superheated steam the dilute solution remaining after the saponification of the oil with lime, in the manufacture of stearin candles. Crude glycerin is obtained in a similar manner from residues of soap-making. 2. What is the difference between glycerin and nitro-glycerin? A. Glycerin is converted into nitro-glycerin by treating it with a mixture of fuming nitric and sulphuric acids. This treatment causes a substitution of nitric acid for the hydrogen in the glycerin. They are entirely different in their properties.

(23) E. H. asks: Why does nitrous oxide gas deteriorate by time? Does the water kill its anesthetic properties by degrees, giving it up to the atmosphere through the space between the water tank and the gasometer? A. Pure nitrous oxide is a permanent gas at ordinary temperatures, and, when isolated, will retain its characteristic properties for an indefinite length of time. The gas is quite soluble in cold water, and if inclosed in a tight vessel, in contact with a quantity of water, it will displace much of the air held in solution therein, which, mixing with the unabsorbed gas, will of course dilute it. Again, if the water or the gas reservoir contains any quantity of organic matters, they will become oxidized at the expense of a portion of the oxygen of the nitrous oxide, liberating at the same time the equivalent of inactive nitrogen. But ordinarily the chief cause of the dilution may be attributed to the gradual diffusion of air and gas through the water, joints, rubber tubing, valves, etc. As the density of nitrous oxide is something more than that of air, the diffusion is in favor of the entrance of the air over the exit of the gas in the reservoir.

(24) A. E. D. says: How are moulds for cakes of toilet soap made? I made some of plaster of Paris, and ran the soap in them, but the soap did not form smoothly, little holes forming on the surface. A. Use moulds made of tinned iron.

(25) E. W. asks: Are the glasses which make an achromatic lens ground separately? A. Yes. 2. Will a single lens 1 1/4 inches in diameter do for a small camera? A. A single achromatic lens will make a picture whose diameter equals 1/2 the focal length of the lens. The smaller the aperture, the sharper and better the picture.

What size of engine would it require to run a lathe of 6 inches swing? A. Such a lathe will require 1/4 horse power to work it.

(26) A. S. B.—Red, brown, green, and other colored crayons are made with fine pipeclay, worked into a paste with water and intimately mixed by grinding with earthy or metallic pigments, or in general with a body of surface colors; then moulded and dried.

(27) C. B. P. asks: 1. How can I find out whether a telescope is achromatic or not? A. Look at some bright white object, say the moon; and if the edge is not fringed with color, but is clear and white, then the telescope is very nearly achromatic. 2. How can I find out the magnifying power of a telescope? A. Set up two sticks one foot apart at a distance of about two hundred feet from you; look at the sticks through the telescope with one eye and outside with the other. See how many feet on the ground outside the one foot in the telescope appears to cover. This will give the approximate magnifying power.

(28) G. W. M. asks: Is the article on astronomical observations, published in your issue of March 24, which says that the precession of the equinoxes is 50 minutes of arc, correct? A. It should have been seconds of arc, instead of minutes.

(29) J. S. asks: 1. How long does an elephant live? A. Elephants attain maturity in 30 years, and live to 150, perhaps to 300. 2. How long does it take elephants to breed? A. The period of gestation is about 30 1/2 months.

(30) J. E. L. asks: How many square miles of territory has England on this side of the ocean? A. About 3,194,000.

(31) R. H. R. asks: How can I color red and polish the edges of books? A. When the edges are trimmed, keep the book in the press, and brush on a coating of dilute gum tragacanth (about 1/4 lb. gum to 1 1/2 gallons), colored to the desired hue with a mixture of 3 parts rose pink with 1 vermilion. Let dry in the press, and burnish with an agate burnisher.

(32) B. J. asks: What can I use as driers for coal tar, when applied as paint? A. We do not know of any such substance; but the addition of a little black oxide of manganese will aid in the drying.

(33) J. McN. asks: What is the best method of whitening the grease obtained from pork scraps, which, on coming from the press, is quite dark in color? I have tried several things, such as carbonate of soda, alum, etc., but have not obtained satisfactory results. A. Agitate the grease with hot water containing 10 per cent of oil of vitriol, allow the impurities to settle, and draw off the fused grease with a siphon.

(34) C. I. K. says: I have a lot of cast and wrought iron pipes used for steam heating, running through a battery room. The fumes from the batteries cause the pipes to corrode. Is there any paint which will protect this? A. Coat the pipes with good asphalt, thinned down with turpentine or naphtha.

(35) E. G. S. says: I find that soluble glass, in the state in which it is in when bought, cannot be used or applied as a paint, by reason of its setting too quickly. I desire to apply it to pine boards, that will be subjected to dampness. I wish to prevent the boards from damp, warping, and smelling, by reason of decay, and thereby prevent the tainting of any matter or articles that the box may contain. Can soluble glass be mixed with paint in any manner without destroying its properties, so that a painter could apply it to the outside of a dwelling house without leaving brush marks? A. Water glass may be mixed with dry zinc white (ox-

ide of zinc) or other similar metallic oxide, not affected by it, to form a paint. Ground asbestos mixed into the strong aqueous solution also forms a good paint. It should be applied with a flowing brush, and rapidly. It cannot, of course, be mixed with oil paints.

From what kind of wood is the best charcoal, for preserving and purifying, made? A. Charcoal made from bones (bone black) is best for this purpose. If wood charcoal is to be used, the best is from willow or other light wood.

(30) E. H. says: If a steam boiler, having water at a proper height and steam at 60 lbs. pressure, should be closed so that no steam could escape, and fired enough to maintain the same pressure for 1 hour, would the water be any lower in the boiler at the end of that time than at first? Would there not be the same amount of water in the boiler? A friend claims that there would be less, as the water "would dry up." A. There would be no change in the amount of water.

(37) J. K. M. says: Please give me a recipe for reducing quicksilver to a fluid, for plating brass and copper? A. We do not understand you. Mercury (quicksilver) is liquid at ordinary temperatures. Brass and copper may be coated with mercury by applying the metallic mercury directly to the clean surface of the article to be coated. Or an aqueous solution of the chloride of mercury (corrosive sublimate) may be used as a dipping bath. Corrosive sublimate is prepared by first converting the metal or its oxides into protochloride of mercury, and then subliming this with common salt. Or the mercury may be converted into the red oxide by cautiously heating the sulphate, and this, dissolved in hydrochloric acid and the solution evaporated until crystallization takes place, gives the corrosive sublimate. In inexperienced hands, these reactions are dangerous.

(38) H. F. asks: Can you give me a recipe for making red aniline ink for rubber stamp use? How can I make red and blue ink for stamp ribbons? A. For red, dissolve alizarin or aniline red in warm glycerin. For blue, make a glycerin solution of aniline blue. These inks will serve for ribbons as well as for inking pads.

(39) W. H. asks: How can I convert the degrees centigrade to Fahrenheit and Fahrenheit degrees to centigrade? A. To convert centigrade to Fahrenheit, multiply by 9, divide by 5, and add 32. Thus: $100^{\circ}\text{C.} \times 9 = 900$; divide by 5 = 180; + 32 = 212°F. To convert Fahrenheit to centigrade, deduct 32, multiply by 5, and divide by 9. Thus $212^{\circ}\text{F.} - 32 = 180$; $180 \div 9 = 20$; $20 \times 5 = 100^{\circ}\text{C.}$

(40) G. H. E. S. asks: 1. How can I produce musical sounds from glass tumblers? A. Moisten the fingers with water, and with their tips pressed firmly on the rim of the goblet, move them quickly around it so as to jar the glass and cause it to vibrate. You will probably succeed after a few trials. 2. What is made use of for moistening the fingers, to produce the sound? A. Water is generally used; but a better way is to moisten the finger tips with a drop of turpentine, and then rub them in finely powdered resin. If resin is employed, the goblet must be clean and dry.

(41) W. L. Y. asks: How is French mustard prepared? A. Take salt, 1½ lbs., scraped horseradish, 1 lb.; garlic, 2 cloves; boiling vinegar, 2 gallons. Macerate in a covered vessel for 24 hours, strain, and add sufficient flour of mustard.

(42) S. B. says: I have seen some chimneys on dwelling houses that sweat, or have the appearance of being wet. Please give the cause. A. Damp air when suddenly chilled precipitates water, as is seen by the result of the air of a room coming in contact with a pitcher of cold water; and from this cause the water coming from flues can be accounted for. When the flue is not used for a fire, it still acts as a ventilator, and as the warm air from the interior of the house comes in contact with the cold air falling from the top of the flue, it throws off its moisture and deposits it upon the interior surfaces of the flue.

(43) D. D. says: 1. Has a drum with two partitions, utilizing the heat from stove pipe, ever been tried? A. We are not aware of such a device for that purpose. 2. I am informed that, in London, dwellings are constructed with chimneys that return the smoke to the furnace, where it is burned, instead of throwing it out upon the open air. Can you give me any information in regard to the construction of such chimneys? A. We think there must be some mistake as to there being chimneys of such construction in use in dwellings; many factories in England are compelled by law to construct smoke-burning chimneys. We have not at hand the data required to give the precise nature of their construction. 3. What is the cheapest and best preparation for the preservation of shingles? A. Probably a wash of lime, tinted to suit.

(44) J. O. says: We desire information in the matter of conveying water in iron pipes. We wish to carry a spring running about 1 mile (12 gallons per minute) of water a distance of about 5 miles over a broken country. The spring is at least 50 feet higher than the point of delivery. Two thirds of the first mile is a regular descent down a mountain side, fall in that distance being about 600 feet. The remainder of the distance is around the base of a mountain, broken up by gulches and ravines not very abrupt. The first two miles gradually descend 50 to 100 feet, thence gradually ascending to point of delivery. We propose to use 1 inch (inside diameter) iron pipe, lap weld, providing some means for the escape of air at every summit, but have been told that water cannot run through a pipe of that size for that distance if the grade was on a straight line from the spring to the point of delivery on account of the friction. Please tell us the best mode of conveying said stream of water? A. The greatest difficulty you have to encounter is in the siphons; but supposing these to work well and no leakage to the pipe, the water will discharge at the lower point notwithstanding the friction. The friction is in proportion to the velocity, but the velocity being reduced to a minimum, the water will flow to some extent; it will also soon acquire a momentum that will in a measure compensate for the friction, and if received in a reservoir it will finally discharge all the water supplied. Water will find its level, and the important condition here is that the point of discharge shall be lower than the spring.

(45) J. H. asks: What is the best way for testing a boiler, to find out how much fuel it burns? A. We think there is only one method that will be satisfactory, to weigh the fuel before putting it into the furnace.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the result stated:

J. A. A.—They consist of sulphate of iron, together with some organic matter, the nature of which we cannot undertake to examine.—J. K. W.—No. 1 consists principally of clay containing a large quantity of sesquioxide of iron. It might be used with oil as a cheap paint. No. 2 is a variety of sandstone. No. 3 appears to be powdered basalt, with small crystals of quartz and sulphide of iron.

F. H. says: We have a lot of postal cards, on one side of which is printed a circular. Is there any cheap preparation that I can make which will take this printing off, and leave the card fit to write on?

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On Prismatic Pictures. By J. C.
On a New Motor. By A. M.
On Glass for the Studio, etc. By T. G.
On Scientific Experiments. By J. P.
On Kaolin. By H. K. K.
On Blue Glass. By J. S. B.
On the Welding of a Mill Spindle Point. By H. B., by A. M. W., by W. J. F., by J. H. P., by R. L. C., by N. W. T., and by J. O.
On the Mountains in the Moon. By P. E. S.
On Early Locomotive Engineering. By J. V. B.
On Carelessness in Sawmills. By L. D. D.
Also inquiries and answers from the following:
H. M.—G. H. B.—A. W. S.—C. R.—L. S. B.—S. R. S.—J. W. F.—F. C.—H. R.—J. M.—C. A. S.—J. D. H.—J. H. C.

HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Inquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of inquiries analogous to the following are sent: "Who sells a preparation for blasting tree stumps, which is safer than gunpowder, dynamite, or nitroglycerin? Who sells telephones, and what do they cost? Who sells rope belting, and what does it cost? Who sells platinum, nickel, tungsten, and aluminum? Whose is the best mangling machine?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

OFFICIAL.

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were

Granted in the Week Ending

March 27, 1877.

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

Advertising case, E. D. Richmond..... 188,954
Advertising frame, W. H. Naulty..... 188,914
Agricultural socket, T. B. De Forest (r)..... 7,567
Air cooling apparatus, J. C. Mack..... 188,923
Air heating furnace, E. H. Doyle..... 188,729
Air pump and condenser, S. B. Root..... 188,958
Alarm clock, H. J. & W. D. Davies..... 188,925
Alarm lock and door bell, L. Griswold..... 188,795
Animal trap, Pownall & Broome..... 188,753
Apple corer and quarterer, S. J. Renner..... 188,819
Aquarium, flower stand, etc., Peltier & Hoerning..... 188,941
Axes, manufacture of, W. G. Howell..... 188,799
Baby walker, J. C. Frederick..... 188,885
Bale tie, A. Barbarin..... 188,768
Bale tie, F. Cook..... 188,725
Bale tie, G. S. France..... 188,884
Bale tie, cotton, J. N. Lanth..... 188,742
Bale ties, cotton, S. M. Wilson..... 188,908
Bale tire, wire, E. P. Bennett..... 188,845
Barber's apron, A. H. Hart..... 188,737
Barrel gage, F. Kuhlman..... 188,893
Barrels, setting up, W. H. Ewing..... 188,787
Bed bottom, spring, W. M. Edmans..... 188,878
Belt shifter, elevator, J. Aeckerle..... 188,834
Bessemer converter bottoms, A. J. Haws..... 188,899
Bobbin, W. F. Draper..... 188,784
Boiler furnace, E. Fair..... 188,733
Boot heel plate, Buxton & Greeley..... 188,854
Boot lacing stand, A. Dawes..... 188,780
Boot nails, driving, H. Dunham..... 188,774
Bottle neck, cork fastening, J. Young..... 188,907
Bottle stopper, D. T. Robinson (r)..... 7,581
Bottle stopper, D. G. Smith..... 188,920
Bottle washer, A. Fisher..... 188,882
Bridle bit, F. Crano..... 188,726
Brush, H. Rosenthal..... 188,909
Buffing machine, etc., J. McWilliams..... 188,900
Bung for barrels, B. F. Bonaventura..... 188,849
Butter package, E. J. & M. Rosfield..... 188,963
Button hole cutter, N. A. Rogers..... 188,976
Button machinery, C. Radcliffe..... 188,944
Can jacket, U. B. Campbell..... 188,955

Car coupling, R. J. & R. N. White..... 188,996
Car door, G. L. Wallt..... 188,994
Car dumping apparatus, J. L. Mitchell..... 188,812
Car heater, W. H. Kilbourn..... 188,802
Car pedestal spring seat, G. W. Morris..... 188,723
Cass, etc., lifting horse, H. O. Baker..... 188,818
Carpet fastener, A. Rosello..... 188,790
Carpet stretcher, W. M. Galusha..... 188,800
Carriage, child's, J. Jenkinson..... 7,569
Cartridge, H. Kellogg (r)..... 188,872
Cartridge loading implement, J. H. Dudley..... 188,922
Casting ingots of steel, C. Shunk..... 7,582
Chair, A. B. Stevens (r)..... 188,899
Chair and cradle, A. Goldschmidt..... 188,869
Chair, folding, E. Smith..... 188,730
Change gate, W. A. Dutton..... 188,863
Churn, H. P. Daggett..... 188,813
Churn dasher, J. G. Montgomery..... 188,922
Cigar holder, F. H. W. Von Tiedemann..... 188,893
Cigar machine, F. Hachnel..... 188,894
Cigar machine, C. Muller..... 188,892
Cigar wrapper cutter, F. Hachnel..... 188,795
Cigarettes, making, L. Grosskopf..... 188,854
Clock and mirror, H. J. Davies..... 188,850
Clothes pounder, A. Bugbee..... 188,748
Coal screen, E. D. McLean..... 7,583
Coffee mill, T. Stroblorg (r)..... 188,982
Coin detector, counterfeit, J. W. Sutton..... 188,730
Colter journal, G. Moore..... 188,800
Combination lock, Goodrich & Chapman..... 188,754
Corn dropper, J. Putnam..... 188,908
Corn marker, M. Zimmerman..... 188,888
Corn planter, C. L. Goethals..... 188,960
Corn planter, W. W. Hubbard (r)..... 7,577
Corn planter, H. Striewig..... 188,942
Corn planter, self dropping, J. W. Perry..... 188,901
Corn shelling implement, H. P. Meggs..... 188,933
Corpses, preserving, G. Henry..... 188,894
Corset, T. F. Hamilton..... 188,895
Cotton clopper, J. P. Harrison..... 188,928
Cotton gin feeder, etc., G. W. McCauley..... 188,815
Cultivator, H. W. Nichols..... 188,883
Curtain fixture, A. H. Foster..... 188,965
Curtain fixture, D. B. Tiffany..... 188,756
Cutlery scourer, L. K. Dutton..... 188,771
Cutter head, M. T. Boulton..... 188,778
Ditching and tile laying, T. G. Coll..... 188,833
Doffer combs, operating, E. Wright..... 188,728
Doors, device for closing, I. S. Doten..... 188,751
Drawer pull, L. Muller..... 188,762
Drawer pull, Whiteman & Gerardin..... 188,940
Drawers, A. Packsocher..... 188,896
Dress chart, M. Harrison..... 188,773
Drilling shanks of rivets, M. Bray..... 188,905
Engine, portable traction, N. M. Davidson..... 188,732
Engine, rotary, Pasquale & Zanini..... 188,901
Eyeglass, H. H. Hempler..... 7,571
Faucet, F. Roach (r)..... 188,816
Fence, portable, G. S. Pickett..... 188,916
Fence, wire, Johnson & Johnston..... 188,929
Fire extinguishing, D. McLennan..... 188,817
Fire escape, W. C. Pulaski..... 188,888
Fireplace, S. B. Baker..... 188,735
Fishing float and sinker, P. S. Redfield..... 7,575
Fly trap, H. A. Farnam (r)..... 188,977
Force pump, W. N. Starr..... 188,804
Fringe, M. Landenberger..... 188,972
Fruit drier, O. N. Smith..... 188,858
Furnace, soldering iron, Cook & Jones..... 188,763
Furnace slag, treating, C. Wood..... 188,914
Furnaces, etc., heating air for, J. Jenks..... 188,913
Furnaces, feeding air to, J. Jenks..... 188,756
Gaging and centering tool, F. A. Rich..... 188,917
Garden weeder, hand, M. Johnson..... 188,836
Gas burner, J. Anderson..... 188,819
Gas carburetor, W. W. L. Kemp..... 188,807
Gas lighter, E. Lindsley..... 188,740
Gas regulator, Kipp & Murphy..... 188,832
Gases, purifying furnace, J. Burt..... 188,745
Glass, annealing, J. Lowery..... 188,876
Governor, Durham & Howse..... 188,747
Governor, wind wheel, O. P. McDonald..... 188,861
Grain binder, H. Curtis..... 188,756
Grain separator, D. Butler..... 188,924
Grain vessels, unloading, C. J. Mann..... 188,867
Grate bar, H. B. Denny..... 188,783
Grinding mill, J. S. Detwiler..... 188,953
Hames, holdback for, J. Robbins..... 188,871
Harrow, J. H. Dolan..... 188,871
Hat, C. E. Richards..... 188,758
Hat block spinner, C. Sieber, Jr..... 188,727
Hatchway, G. N. Creamer..... 188,869
Heater, B. G. Devoe..... 188,975
Hinge, J. Spruce..... 188,793
Hinge for awning blinds, J. J. Greenough..... 188,829
Hoop poles, sawing, G. Thompson..... 188,929
Hoop poles, splitting, J. A. Peoples..... 188,843
Horse brush, C. W. Belser..... 188,955
Horse detach, A. B. Roberts..... 188,927
Horse hay rake, J. Hollingsworth..... 188,821
Horse power, J. S. Shelly..... 188,927
Horseshoe, G. P. Sheffeld..... 188,858
Horseshoe calk sharpener, R. Denholm..... 188,770
Horseshoe nails, finishing, R. Bevelander..... 188,824
Horseshoe swage, J. Smith..... 188,838
Horseshoes, attachment, M. McBarren..... 188,886
Hose coupling, J. Galvin..... 188,909
Hose nozzle, C. A. Howard..... 188,932
Hot air furnace, W. E. Henderson..... 188,945
Ice machine, T. L. Rankin..... 188,795
Insects, destroying, Bagnick & Groeschel..... 188,790
Insect trap, B. Sylvester..... 188,731
Inside blind, A. T. Efford..... 188,757
Jewel settings, opening, J. Schwerter..... 188,722
Key for locks, Abbott & Parrish..... 188,827
Key for locks, C. H. Stewart..... 188,974
Key hole escutcheon, J. Spruce..... 188,826
Knob latch, C. H. Stewart..... 188,946
Knobs to spindles, attaching, W. Regan..... 188,909
Lamps, D. Whiteford..... 188,905
Lamp extinguisher, Neddo & Walton..... 7,568
Lamp, street, J. S. Hagerty (r)..... 188,735
Lanlan quarter light, B. Dunn..... 188,798
Lawn mower, W. C. Farnum..... 188,882
Life boat, P. B. Curtis..... 188,792
Life boat, C. Dickenson..... 188,902
Lock for cell doors, J. Sargent..... 188,971
Locomotive, T. V. Smith..... 188,900
Loom let-off mechanism, Widdup & Thompson..... 188,936
Loom shuttle, E. W. Marble..... 188,951
Looms, pattern chain for, C. Strobel..... 188,844
Magazine fire arm, T. G. Bennett..... 188,905
Measuring pump, C. Hildebrand..... 188,870
Middlings separator, E. Dolman..... 188,838
Middlings separator, M. H. Palmer..... 188,906
Mill spindles, bushing for, A. L. Tippet..... 188,810
Nailing and pegging machine, G. McKay..... 188,746
Oil well cleaner, M. T. McCormick..... 188,744
Organ stop knob, W. H. Currier..... 188,796
Packing steam, J. W. Hawkins..... 188,952
Packing, making piston, P. W. Richards..... 188,781
Padlock, A. Deikenscamp..... 188,794
Paper bag, A. L. Slager..... 188,794
Paper bag machine, T. W. Grinter..... 188,963
Paper bag machine, Richardson & Gibbs..... 7,579
Paper box, A. Powers (r)..... 188,779
Paper, etc., folding, L. C. Crowell..... 188,997
Paper-folding machine, S. D. Tucker..... 188,964
Penmanship, teaching, J. D. Taylor..... 188,790
Perambulator, E. G. Allen..... 188,805
Photograph bath warmer, Fallath & Schnell..... 188,805
Pills, etc., making, T. J. Young..... 188,881
Pipe welding tongs, J. Fieldhouse..... 188,905
Pitman, D. L. Lewis..... 188,907
Platine board, S. G. Otis..... 188,806
Planing pressure bar, G. E. Newall..... 188,739
Plow, A. B. Farquhar..... 188,856
Plow, sulky, H. E. Carver..... 188,797
Plow, sulky, O. D. Hall..... 188,803
Pocket, safety, M. Von Gerichten..... 188,905
Post hole auger, A. Graham..... 188,774
Preserving meat, etc., M. Brenner..... 188,777
Printer's bodkin, W. Chester..... 188,755
Printers' rolls, renovating, B. F. Allen..... 188,964
Pump, J. Schrankel..... 188,828
Pump, T. B. Swan..... 188,764
Pump handle and rod joint, S. J. Adams..... 188,879
Pump, ship's, Ellis & Loud..... 188,879
Punch, numbering, Westcott & al..... 188,777
Railway curve, D. E. Dutrow..... 188,846
Railway rails, leveling, J. Beugger..... 188,854
Railway switch, D. A. Burr..... 188,830
Razor strop, J. R. Torrey..... 188,830
Refrigerator, J. H. Reynolds..... 188,948
Refrigerator car, J. H. Wickes..... 188,901
Rivet making machine, M. Bray..... 188,724
Rock drilling machine, T. B. Ford..... 188,741
Rolling, metal, A. Klemm..... 188,901
Saddle, H. Ruwart..... 188,775
Safe, fireproof, W. H. Butler..... 188,948
Saw teeth, setting, A. Bolsonet..... 7,574
Screw blanks, nicking, American Screw Co. (r)..... 7,573
Screws, making, T. Rickett..... 7,573
Screws, threading, American Screw Co. (r)..... 188,997
Seal belt, A. F. Whiting..... 188,749
Seat and couch, C. A. Mikinas..... 188,811
Seed planter, W. D. Miller..... 188,907
Seed planter, H. J. Robinson..... 188,767
Sewing machine, G. W. Baker..... 188,943
Sewing machine winder, C. T. Powers..... 188,809
Sewing machine, boot, G. McKay..... 188,905
Shelf, detachable, E. Sears..... 188,801
Shovel, J. T. Tyler..... 188,832
Show case, T. Vaughan..... 188,955
Sink, B. Wallace..... 188,904
Skylight bar, J. Henry..... 188,792
Slate frame, H. C. Goodrich..... 188,840
Slate, hinged, R. S. Barnum..... 188,897
Spark extinguisher, J. J. Gilbert..... 188,729
Speed indicator, W. Heckerl..... 7,575
Spinning bobbin, etc., T. L. Luders (r)..... 188,825
Spinning machine ring, W. T. Carroll (r)..... 188,736
Spinning quill, J. C. Stanley..... 188,922
Spinning, ring, J. Goulding..... 188,900
Spring shaping machine, E. C. Lewis..... 188,915
Stamp, perforating, J. L. Wickes..... 188,990
Station indicator, C. Jensen..... 188,990
Steam generator, A. Van Horn..... 188,820
Steel, manufacture of, H. Schierloh..... 188,809
Steering apparatus, power, A. Crosby..... 188,709
Stereoscope, A. Beckers..... 188,921
Stocking, M. Landenberger, Jr..... 188,972
Stove, H. M. Smith..... 188,968
Stove, cooking, E. S. Shantz..... 188,827
Straw cutter, J. E. Andrews..... 188,791
Straw cutter, W. S. Gibson..... 188,873
Sugar, treating, Duncan & Newlands..... 188,901
Sulphurous acid, making, W. D. Jones..... 188,759
Tackle block, Simpson & Pope..... 188,920
Tag, E. F. Krelwitz..... 188,927
Thill, center draft, C. H. Matthiessen..... 188,933
Thill coupling, B. P. Morrison..... 188,901
Tobacco, marking plug, E. C. Venable..... 188,847
Tobacco transplanter, J. W. Beverly..... 188,918
Towel rack, S. T. Kanuse..... 188,841
Toy, automatic, W. Baxter, Jr..... 188,873
Toy frog, E. Durand..... 188,829
Toy, musical, C. W. Banks..... 188,903
Toy ship, G. Taylor..... 188,910
Trace buckle, T. J. Hubbell..... 188,947
Transom lifter, F. A. Reiber..... 188,759
Treadles, etc., attaching, A. Hitchcock..... 188,900
Trunk catch, E. Rice..... 188,806
Tubing oil wells, etc., Lewis & Boynton..... 7,572
Umbrella tip cup, O. M. Smith (r)..... 188,857
Umbrella tip cup, etc., C. C. Clay..... 188,900
Vapor burner, J. G. Hobert..... 7,578
Ventilation, car, C. G. Lea (r)..... 188,906
Ventilator, G. Yen..... 188,869
Ventilator for chimneys, A. Van Horn..... 188,735
Washing machine, W. W. Goodwin..... 188,842
Water channels, prevent obstruction, L. H. Beebe..... 188,897
Water closet basin, C. Harrison..... 188,988
Water elevator, A. Vantrump..... 188,911
Water wheel, S. C. Humphreys..... 188,979
Water wheel, A. B. Strand..... 188,909
Water wheel and gate, J. W. Ross..... 7,580
Well, driven or bored, J. E. Morrison (r)..... 188,912
Whiffletree iron, J. Irvine..... 188,925
Windlass, F. S. Manton..... 188,938
Windmill, W. T. Burrows..... 188,743
Windmill, J. Lechhead..... 188,724
Window screen and awning, S. Colahan..... 188,808
Window shutter, Hopkins & Johnston..... 188,903
Wrench, J. Shepard..... 188,928
Wrench, adjustable tap, R. H. St. John..... 188,928

DESIGNS PATENTED.

9,362.—COOK STOVE.—A. P. Corso, Troy, N. Y.
9,367.—PAPER BOXES.—L. P. Heath, Springfield, Mass.
9,368.—BALL ROOM FAYORS.—M. Keppler, N. Y. city, N. Y.
9,369.—MATCH BOXES.—F. Markoe, Philadelphia, Pa.
9,370.—PEN HOLDER, ETC.—P. Schrag, N. Y. city, N. Y.
9,371.—COOK STOVES.—G. Smith et al., Philadelphia, Pa.
9,372.—RANGE.—G. Smith et al., Philadelphia, Pa.

For the week ending March 20.

9,387.—TYPE.—D. W. Bruce, New York city.
9,388.—INSULATOR.—J. M. Brookfield, Brooklyn, N. Y.
9,389.—PLAYING CARDS.—J. H. Bingham, Hartford, Conn.
9,390.—GLASS JARS.—F. L. Bodine, Philadelphia, Pa.
9,391.—FORK HANDLES, ETC.—J. M. Culver, Wallingford, Conn.
9,392.—HEAD COMB.—P. J. Callinan, New York city.
9,393.—ERASER PENCIL.—F. H. Holton, Brooklyn, N. Y.
9,394.—BURIAL CASES.—A. H. Nirdlinger, Rochester, N. Y.
9,395.—PICTURE EXHIBITOR.—J. W. Taft, Chicago, Ill.

[A copy of any of the above patents may be had by remitting one dollar to MUNN & CO., 37 Park Row, New York city.]

FOR ALL PURPOSES.
A SPECIALTY OF HEAVY PRESSURES.
THE NORWALK IRON WORKS CO.,
NORWALK, CONN.

Advertisements.

Inside Page, each insertion --- 75 cents a line.
Back Page, each insertion --- \$1.00 a line.
Engravings may be inserted at the same rate per line, by measurement, as the letter press. Advertisements must be received at publication office as early as Friday morning to appear in next issue.

GUARDIOLA'S
COFFEE & SUGAR MACHINERY
Coffee, Malt, Corn, Cocoa, and Grain-Drying Machine. Coffee-Hulling and Polishing Machine. Coffee-Washing Machine. Helix Sugar Evaporator.

Messrs. C. ADOLPH LOW & CO., 22 Cedar Street, New York, are Mr. Guardiola's Agents, and they will give prompt attention to all orders for any of the above machines.

Best Tempered Cast Steel.
Retail Price, 9 Cents per lb.
WARRANTED. Send for Circular.
Fisher & Norris, Trenton, N. J.

Incombustible Mineral Wool
The best and cheapest insulator of heat or cold. Send for circulars, 325 Broadway, New York.
ALEXANDER D. ELLERS, Agent for the Patentee.
P. O. Box 4461.

MACHINISTS' TOOLS.
NEW AND IMPROVED PATTERNS.
Send for new illustrated catalogue.

Lathes, Planers, Drills, &c.
NEW HAVEN MANUFACTURING CO.,
New Haven, Conn.

CELEBRATED FOOT LATHES.

Foot Power Back-gear Screw Lathes, Small Hand and Power Planers for Metal, Small Gear Cutters, Slide-rests, Ball Machine for Lathes, Foot Circular Saws, light and heavy Foot Circular Saws. Just the articles for Amateurs or Artisans. Highly recommended. Send for illustrated Catalogue.
N. H. BALDWIN, Laconia, N. H.

PATENTEE'S or makers of useful and saleable articles should send me samples. I advertise direct to 25,000 Agents and Dealers. Articles retelling for 25 cents or less preferred. DAVID C. COOK, 46 Madison St., Chicago, Ill.



[ESTABLISHED 1846.]

Munn & Co's Patent Offices.

The Oldest Agency for soliciting Patents in the United States.

THIRTY YEARS' EXPERIENCE.

MORE PATENTS have been secured through this agency, at home and abroad, than through any other in the world.

They employ as their assistants a corps of the most experienced men as examiners, specification writers, and draughtsmen, that can be found, many of whom have been selected from the ranks of the Patent Office.

SIXTY THOUSAND inventors have availed themselves of Munn & Co.'s services in examining their inventions and procuring their patents.

MUNN & CO., in connection with the publication of the **SCIENTIFIC AMERICAN**, continue to examine inventions, confer with inventors, prepare drawings, specifications, and assignments, attend to filing applications in the Patent Office, paying the Government fees, and watch each case, step by step, while pending before the examiner. This is done through their branch office, corner F and 7th Sts., Washington. They also prepare and file caveats, procure design patents, trade marks, and releases, attend to rejected cases (prepared by the inventor or other attorneys), procure copyrights, attend to interferences, give written opinions on matters of infringement, furnish copies of patents, and, in fact, attend to every branch of patent business, both in this and in foreign countries.

A special notice is made in the **SCIENTIFIC AMERICAN** of all inventions patented through this agency, with the name and residence of the patentee. Patents are often sold, in part or whole, to persons attracted to the invention by such notice.

Patents obtained in Canada, England, France, Belgium, Germany, Russia, Prussia, Spain, Portugal, the British Colonies, and all other countries where patents are granted, at prices greatly reduced from former rates. Send for pamphlet pertaining specially to foreign patents, which states the cost, time granted, and the requirements for each country.

Copies of Patents.

Persons desiring any patent issued from 1836 to November 26, 1867, can be supplied with official copies at reasonable cost, the price depending upon the extent of drawings and length of specifications.

Any patent issued since November 27, 1867, at which time the Patent Office commenced printing the drawings and specifications, may be had by remitting to this office \$1.

A copy of the claims of any patent issued since 1836 will be furnished for \$1.

When ordering copies, please to remit for the same as above, and state name of patentee, title of invention, and date of patent.

A pamphlet, containing full directions for obtaining United States patents, sent free. A handsomely bound Reference Book, gilt edges, contains 140 pages and many engravings and tables important to every patentee and mechanic, and is a useful handbook of reference for everybody. Price 25 cents, mailed free.

Address **MUNN & CO.,**
Publishers **SCIENTIFIC AMERICAN,**
37 Park Row, N. Y.

BRANCH OFFICE—Corner of F and 7th Streets, Washington, D. C.

NOYE'S
MILL FURNISHING WORKS
are the largest in the United States. They make Burr Millstones, Portable Mills, Smut Machines, Packers, Mill Picks, Water Wheels, Pulleys and Gearing, specially adapted to flour mills. Send for Catalogue.
J. T. NOYE & SON, Buffalo, N. Y.

ESTABLISHED 1844.
JOSEPH C. TODD,
(Formerly of Todd & Rafferty), ENGINEER and MACHINIST. Flax, Hemp, Jute, Rope, Oakum, and Bagging Machinery. Steam Engines, Boilers, etc. Also Agent for the celebrated and Improved Rawson & Rittinger Hoisting Engine. I will furnish specifications and estimates for all kinds of machinery. Send for descriptive circular and price. Address
J. C. TODD,
10 Barclay St., New York, or Paterson, N. J.

JOS. G. ROGERS & CO., MADISON, IND.,
wish to place a consignment of their Tannate of Soda BOILER SCALE PREVENTIVE in all important towns in the United States, to be sold on commission. Applications solicited. Send for book on Boiler Incrustation.

NON-COMBUSTIBLE STEAM BOILER AND PIPE COVERING
WITH "AIR SPACE" IMPROVEMENT.
Saves 10 to 20 per cent. CHALMERS SPENCE CO.,
Foot E. 9th St. N. Y.; 1322 N. 2d St., St. Louis, Mo.

HARTFORD
STEAM BOILER
Inspection & Insurance
COMPANY.

W. R. FRANKLIN, V. Pres't. J. M. ALLEN, Pres't.
J. B. PIERCE, Sec'y.

\$5 to \$20 per day at home. Samples worth \$5 free. STINSON & CO., Portland, Me.

STEAM PUMPS
Wright's Pat. Bucket Plungers are the best.
VALLEY MACHINE CO.,
Easthampton, Mass.

PERFECT
NEWSPAPER FILE

The Koch Patent File, for preserving newspapers, magazines, and pamphlets, has been recently improved and price reduced. Subscribers to the **SCIENTIFIC AMERICAN** and **SCIENTIFIC AMERICAN SUPPLEMENT** can be supplied for the low price of \$1.50 by mail, or \$1.25 at the office of this paper. Heavy board sides; inscription "SCIENTIFIC AMERICAN," in gilt. Necessary for every one who wishes to preserve the paper.
Address
MUNN & CO.,
Publishers **SCIENTIFIC AMERICAN.**

MACHINERY OF IMPROVED STYLES FOR making SHINGLES, HEADING and STAVES; also GAUGE LATHES for TURNING HANDLES. Sole makers of Law's Pat. Shingle and Heading Sawing Machine. Address
TREBOR & CO., Lockport, N. Y.

TO INVENTORS
AND MANUFACTURERS

FOLLOWS & BATE, Manchester, England, Hardware and Machinery Merchants, are prepared to buy American Goods for Cash, and to act as Sole Wholesale Agents.

WOODWORTH SURFACE PLANERS, \$125. Planers and Matchers, \$50. S. C. HILLS, 78 Chambers Street, New York.

DROP FORGINGS and SPECIAL MACHINERY.
THE HULL & BELDEN CO.,
Danbury, Conn.

LeCOUNT'S PATENT
Machinists' Tools.
REDUCED PRICES.
Set Iron Dogs, 3-8 to 2 in., - - - - - \$5.00
" " 3-8 to 4 in., - - - - - 12.00
" Steel " 3-8 to 2 in., - - - - - 6.00
" " 3-8 to 4 in., - - - - - 13.00
Iron & Steel Clamps, Die Dogs, Clamp Dogs, Vice Clamps, Expanding Mandrels, &c. Send for latest Price List to
C. W. LE COUNT, South Norwalk, Conn.

DAMPER BEST AND LEVERS
REGULATORS GAUGE COCKS.
MURRILL & KEIZER, 4 HOLLIDAY ST., BALTIMORE.

Brayton Ready Motor

It has no boiler, is safe, economical, started by any one in one minute, occupies small space, and gives an unsurpassed steady, reliable power. Address
Penna. Ready Motor Co.,
20 N. 4th St., Philadelphia, Pa.

DUC'S IMPROVED
PATENT ELEVATOR BUCKET,
FOR BREWERS, FLOUR MILLS, GRAIN ELEVATORS, SUGAR REFINERS, &c.
These buckets are made of the best charcoal stamping iron, and are warranted to outwear six of the "OLETTLE BUCKETS." The cost is about the same. Address
T. F. ROWLAND, Brooklyn, E. D., N. Y.

Working Models
And Experimental Machinery, Metal or Wood, made to order by
J. F. WEINER, 61 Center St., N. Y.

BOGARDES' PATENT UNIVERSAL ECCENTRIC MILLS. For grinding Bones, Ores, Sand, Old Crabbles, Fire Clay, Guanoes, Oil Cake, Feed, Corn, Corn and Cob, Tobacco, Soda, Sugar, Salts, Roots, Spices, Coffee, Cocomant, Flaxseed, Asbestos, Mica, etc., and whatever cannot be ground by other mills. Also for Paints, Printers' Inks, Paste Blacking, etc. JOHN W. THOMSON, successor to JAMES BOGARDES, corner of White and Elm Sts., New York.

Pyrometers.
FOR Blast Furnaces, Bakers' Ovens, Boiler Flues, Superheated Steam, Oil Stills, Zinc and Lead Baths. Made under the patents of E. BROWN, 511 Walnut St., Philadelphia. Established 1860.

UPRIGHT DRILL PRESSES.
H. BICKFORD, Cincinnati, O.

Niagara
Steam Pump Works.
ESTABLISHED 1826.
CHARLES B. HARDICK,
No. 23 Adams Street,
BROOKLYN, N. Y.

KNOWLES'
STEAM PUMP WORKS,
92 & 94 Liberty St., New York.
Great reduction in prices. Send for catalogue. The "Knowles" has always been the best steam pump made.

ROCK DRILLING MACHINES
AND
AIR COMPRESSORS.
MANUFACTURED BY **BURLEIGH ROCK DRILL CO.,**
SEND FOR PAMPHLET. **FITCHBURG MASS.**

Type and Printing Materials
FOR SALE.

The following Fonts of Type, in good condition, having been but little used:
Brevier, on Long Primer Body, about 550 lbs.
Brevier, 100 lbs.
Nonpareil, on Brevier Body, 300 lbs.
Agate, 250 lbs.
Sixteen Cases Job Type, in Cabinet.
All the above are Copper-faced.
Leads, Brass Rules, etc.
Cases, 44 pairs.
Column Galleys, brass bottomed, 6.
Chases, wrought iron, 2 pairs, 36x24 inches.
Composing Frames, 4.
Racks, 2.
Imposing Stones, one 75x30 inches, one 72x30, both on stands with drawers.
Roller Press.
The above were used on the **SCIENTIFIC AMERICAN**, and are in clean and perfect condition. The room in which the above is deposited is wanted for other purposes on the first of May, and the lot will be sold very cheap. Apply at the office **SCIENTIFIC AMERICAN**, 37 Park Row, N. Y., for further particulars.

FOR SALE, TO CLOSE THE CONCERN.
Entire contents of Machine Shop, No. 279 Cherry Street, New York city, consisting of 30 h. Steam Boiler, now in good running order, 12 h. p. Steam Engine, Cameron Steam Pump, Planing Machine, Engine Lathes, Milling Machines, Screw Cutters, Ordinary Lathes, Shears, Presses, Small Blower, Force, Vises, Variety of Small Tools, Shafting, Pulleys, Belting, Benches, Patterns, etc. Will be sold in lots to suit purchasers, at very low prices. Apply immediately to E. D. BARLOW, Assignee, as above. Lease of premises—50x200 ft.—for sale.

EAGLE FOOT LATHES,
With Scroll and Circular Saw Attachments, Slide Rest, Tools, &c.; also Small Engine Lathes, Metal Hand Planers, &c. Neatest designs, superior finish. **Low Prices.** Our new Catalogue describes these and every tool necessary for the Amateur or Artisan. Send for it.
WM. L. CHASE & CO.,
95 & 97 Liberty St. New York.

Tube Cleaners for cleaning Boiler Tubes. THE NATIONAL STEEL TUBE CLEANER CO. 314 E. 9th St., N. Y.

\$3 PRINTING PRESS!
Prints cards, envelopes, etc., equal to any press. Larger sizes for large work. Do your own printing and advertising and save money. Excellent spare hour amusement for old or young. Or it can be made money making business anywhere. Send 3c. stamps for large catalogue to
KELSEY & CO., Manufacturers,
Meriden, Conn.

PUNCHING Drop Hammers and Dies, for working Metals, &c. **THE STILES & PARKER PRESS CO.,** Middletown, Conn.

1872, 1873, 1874, 1875, 1876,
SCIENCE RECORD.

A few copies of these splendid books, copiously illustrated, are offered at the following very low prices. Persons desiring a condensed history of the most interesting Facts and Discoveries in the Arts, Sciences, and Inventions, for the years from 1872 to 1876, will find them recorded in the five volumes of the **SCIENCE RECORD**, now offered at half the original price.

Every Department of Science is treated in these volumes, and the important discoveries of the several years are not only faithfully described, but many of the subjects are illustrated with finely executed engravings, prepared expressly for these Annuals.

Among the subjects, the following are the most noteworthy, exhibiting in a condensed form a general account of the Progress of the World:
CHEMISTRY AND METALLURGY,
MECHANICS AND ENGINEERING,
ELECTRICITY, LIGHT, HEAT, SOUND,
TECHNOLOGY, THE USEFUL ARTS,
ROBOTICS AND HORTICULTURE,
AGRICULTURE,
RURAL AND HOUSEHOLD ECONOMY,
MATERIA MEDICA, THERAPEUTICS, HYGIENE,
NATURAL HISTORY AND ZOOLOGY,
METEOROLOGY, TERRESTRIAL PHYSICS,
GEOGRAPHY,
GEOLOGY AND MINERALOGY,
ASTRONOMY,
BIOGRAPHY AND NECROLOGY.

Each yearly volume contains about 600 octavo pages, including a large number of handsome engravings. They are bound in substantial and handsome bindings, and will be mailed on receipt of \$1.25 each, or \$5 for the set of five volumes.

They were published and heretofore sold at \$2.50 each, or \$10 for the set.
State, in remitting for a single volume, which year, from 1872 to 1876, is desired, remembering that the date of the volume of the events and discoveries of the previous year. Sent by mail on receipt of price. Address
MUNN & CO., PUBLISHERS,
37 Park Row, New York city.

PATENT
COLD ROLLED
SHAFTING.

The fact that this shafting has 75 per cent. greater strength, a finer finish, and is truer to gauge, than any other in use, renders it undoubtedly the most economical. We are also the sole manufacturers of the **CELEBRATED COLLIER PAT. COUPLING**, and furnish Pulleys, Hangers, etc., of the most approved styles. Price list mailed on application to
JONES & LAUGHLINS,
Try Street, 3d and 3rd Avenues, Pittsburgh, Pa.
105 S. Canal Street, Chicago, Ill., and Milwaukee, Wis.
227 North 3rd St., Boston, Mass.
122 Broadway, New York, and for sale by
FULLER, DANA, & FITZ, Boston, Mass.
GEO. PLACE & CO., 121 Chambers St., N. Y.

F. ADEE & CO'S PATENT
LEAD STENCH TRAPS.
Positive protection against sewer-gas. Best and cheapest. See illustration, **SCIENTIFIC AMERICAN**, April 14th, 1877, for circular.
F. ADEE, 75 Pearl St., N. Y.

WOOD WORKING TOOLS.
Improved and Patented, of every description.
23 PARK ROW, NEW YORK.
on price list allowed until June 1st, 1877. For full particulars of machinery desired, address
H. H. SMITH,
Smithville, Burlington Co., N. J.

THE TANITE CO.,
STROUDSBURG, PA.
EMERY WHEELS AND GRINDERS.
GEO. PLACE, 121 Chambers St., New York Agent.

BUY YOUR BOILER AND PIPE COVERING
direct from the Manufacturers.
ASBESTOS FELTING CO.,
Front St., near Gouverneur, N. Y.

Pyrometers. For showing heat of Ovens, Hot Blast Pipes, Boiler Flues, Super-Heated Steam, Oil Stills, &c.
HENRY W. BULKLEY, Sole Manufacturer,
140 Broadway, New York.

A. S. CAMERON'S
PATENT
"SPECIAL" Steam Pump
Is the Standard of Excellence at home and abroad.

REDUCED PRICE LIST.				
Number.	PRICE.	Steam Cyl.	Pump Cyl.	Stroke.
0	\$ 50	3 1/2 in.	2 in.	4
1	75	4	3	6
2	100	5	4	8
3	150	6	5	10
4	200	7	6	12
5	275	8	7	14
6	325	9	8	16
7	400	10	9	18
8	425	11	10	20
9	450	12	11	22
10	550	14	13	24
11	700	16	15	26
12	850	18	17	28

Illustrated Catalogue sent free, on application to the Inventor and Sole Manufacturer in the United States.

A. S. CAMERON,
Works, Foot of East 23d St.
NEW YORK CITY.

The HOADLEY
PORTABLE STEAM ENGINE,
WITH AUTOMATIC CUT-OFF REGULATOR
AND BALANCED VALVE.
THE BEST, MOST ECONOMICAL ENGINE MADE
SEND FOR CIRCULAR.
The J. C. HOADLEY CO. LAWRENCE, MASS.
STATE WHERE YOU SAW THIS.

The New \$20 Microscope

is fully equal to any that could have been bought three years ago for \$50. Send for descriptive circular.
For the best book of practical instruction get "How to Use the Microscope," by John Phil. 15 cts. by mail.
INDUSTRIAL PUBLICATION CO., 176 Broadway, N. Y.

CHLORIDE OF CALCIUM.
FOR SALE VERY CHEAP.
RANSOME, 19 Bush Street, San Francisco, Cal.

Prospectus

OF THE
SCIENTIFIC AMERICAN
For 1877,
THE MOST POPULAR SCIENTIFIC PAPER IN THE WORLD.

THIRTY-SECOND YEAR.
VOLUME XXXVI.—NEW SERIES.

The publishers of the **SCIENTIFIC AMERICAN** beg to announce that on the sixth day of January, 1877, a new volume was commenced. It will continue to be the aim of the publishers to render the contents of the new volume more attractive and useful than any of its predecessors.

To the Mechanic and Manufacturer.

No person engaged in any of the mechanical pursuits should think of doing without the **SCIENTIFIC AMERICAN**. Every number contains from six to ten engravings of new machines and inventions which cannot be found in any other publication.

TERMS OF SUBSCRIPTION.

One copy of the **SCIENTIFIC AMERICAN** will be sent for one year, 52 numbers, POSTAGE PREPAID, to any subscriber in the United States or Canada, on receipt of three dollars and twenty cents by the publishers.

One extra copy of the **SCIENTIFIC AMERICAN** will be supplied gratis for every club of five subscribers at \$3.00 each; or six copies for \$16.50 without extra copy. Postage free.

The Scientific American Supplement.

A weekly paper, uniform in size with the **SCIENTIFIC AMERICAN**, but a distinct publication. It contains working drawings of engineering works, and elaborate treatises on every branch of Science and Mechanics, by eminent writers, at home and abroad. An illustrated cover protects the handsomely printed sheets. Price, \$5.00 per annum. Single copies 10 cents.

One copy of the **SCIENTIFIC AMERICAN** and one copy of the **SCIENTIFIC AMERICAN SUPPLEMENT** will be sent for one year, postage prepaid, to any subscriber in the United States or Canada, on receipt of seven Dollars by the publishers.

The safest way to remit is by Postal-Order, Draft, or Express. Money carefully placed inside of envelopes, securely sealed, and carefully addressed, seldom goes astray; but it is at the sender's risk. Address all letters and make all orders, drafts, etc., payable to

MUNN & CO.,
37 PARK ROW, NEW YORK.

THE "Scientific American" is printed with CHAS. ENEU JOHNSON & CO'S INK. Tenth and Lombard Sts., Philadelphia, and 59 Gold St., New York.

Harison Charkaw

2 June

SCIENTIFIC AMERICAN

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. XXXVI. No. 19.
[NEW SERIES.]

NEW YORK, MAY 12, 1877.

[\$3.20 per Annum.
[POSTAGE PREPAID.]



THE MANUFACTURE OF SILVERWARE.—(See page 290.)

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT
NO. 37 PARK ROW, NEW YORK.

O. D. MUNN.

A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year, postage included..... \$3 20
One copy, six months, postage included..... 1 60
Clubs.—One extra copy of THE SCIENTIFIC AMERICAN will be supplied gratis for every club of five subscribers at \$3.20 each; additional copies at same proportionate rate. Postage prepaid.

The Scientific American Supplement

is a distinct paper from THE SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly; every number contains 16 octavo pages, with handsome cover, uniform in size with THE SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, \$5.00 a year, postage paid, to subscribers. Single copies 10 cents. Sold by all news dealers throughout the country.

Combined Rates.—THE SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, postage free, on receipt of seven dollars. Both papers to one address or different addresses, as desired.

The safest way to remit is by draft, postal order, or registered letter. Address MUNN & CO., 37 Park Row, N. Y.

Subscriptions received and single copies of either paper sold by all the news agents.

Publishers' Notice to Mail Subscribers.

Mail subscribers will observe on the printed address of each paper the time for which they have prepaid. Before the time indicated expires, to insure a continuity of numbers, subscribers should remit for another year. For the convenience of the mail clerks, they will please also state when their subscriptions expire.

New subscriptions will be entered from the time the order is received; but the back numbers of either THE SCIENTIFIC AMERICAN or THE SCIENTIFIC AMERICAN SUPPLEMENT will be sent from January when desired. In this case, the subscription will date from the commencement of the volume, and the latter will be complete for preservation or binding.

VOL. XXXVI., No. 19. [NEW SERIES.] Thirty-second Year.

NEW YORK, SATURDAY, MAY 12, 1877.

Contents.

(Illustrated articles are marked with an asterisk.)

Answers to correspondents.....	299	Locomotive engineer, the oldest.....	299
Baby brutes.....	299	Lubricants (9).....	299
Belt, friction of.....	300	Manipulation, curious.....	299
Bichromate of potash, antiseptic.....	298	Mississippi work, Captain Eads.....	298
Blast, a tremendous.....	291	Nickel and cobalt plating.....	298
Biotype resists, new.....	295	Oil and sawdust.....	298
Boilers, capacity of (4) 299, (34).....	300	Panthers in Central Park.....	298
Boilers, leaks in (31).....	300	Paper, transparent (16).....	297
Boilers, management of.....	298	Patent decisions, recent.....	297
Bridge, the Niagara railway.....	297	Patents, American and foreign.....	298
Bryant vase, the.....	291	Patents, official list of.....	300
Business and personal.....	295	Petroleum, the origin of.....	294
Calculating machine, new.....	294	Phosphorus lamp, the (13).....	294
Cannals, cleaning (5).....	299	Photographs by telegraph.....	297
Centrifugal force, the (7).....	299	Polishing copper (18).....	299
Correspondence, our Washington.....	292	Powder for mining coal (36).....	300
Dead, dangers from the.....	295	Practical mechanism—No. 29.....	298
Drying horses by electricity.....	291	Propeller, slip of a (6).....	299
Dryers, paint (28).....	297	Pyroligneous acid (19).....	299
Dyeing wood blue (15).....	299	Railway ticket manufacture.....	297
Education, self.....	299	Salicylic acid.....	294
Engineers, duties of.....	292	Screw-cutting, remarkable.....	296
Explosions, remarkable.....	292	Silverware, manufacture of.....	297, 298
Fire escape, a simple.....	299	Speeds, high (35).....	300
Fire escape, improved.....	294	Spindles, welding (22, 23, 24, 25).....	300
Flywheels, proportions of (22).....	300	Star, temporary, what is a.....	299
Friction of a planed surface (11).....	299	Steam, pressure of (36).....	300
Friction of a propeller (10).....	299	Stream power and its utilization.....	299
Galvanizing iron (14).....	299	Sun and the fire (39).....	300
Great Eastern, the.....	299	Timber, decay of.....	299
Gun, the Krupp (3).....	299	Time, pneumatic transmission of.....	299
Iceland spar, new facts about.....	291	Torpedo, a fast.....	295
Inventions patented in England.....	298	Vegetarianism, on.....	296
Inventive progress, American.....	292	Washing hard-finished walls (27).....	300
Iron girders, strength of (1).....	299	Water, tannic acid for testing.....	296
Labor-saving appliances.....	294	Water works of Baltimore, the.....	298
Lands below the ocean level.....	298	Weight, distribution of (8).....	299
Launches, the Thorneycroft fast.....	296	Well, a wonderful spouting.....	296
Lions, young, in Central Park.....	296	Zinc, purifying.....	291
Lightning rods (31).....	299		

TABLE OF CONTENTS OF THE SCIENTIFIC AMERICAN SUPPLEMENT, No. 71,

For the Week ending May 12, 1877.

I. MECHANICS AND ENGINEERING.—Refrigerating Freight Cars.— New Passenger Station at Washington, D. C. Baltimore and Potomac Railroad, 1 engraving.—Iron Railway Cars in Belgium.—Furnace for the Combustion of Bituminous Coal without Smoke. By J. B. HOYT. 2 en- gravings.—Eight Horse Power Traction Engine, by Marshall & Co., 3 engravings.—Steel Making, Direct Process, Larkin's Method.—Iron as a Building Material. Its defects specially pointed out.—Tempering Spring and Tool Steel. Useful Directions.—Opening of the New Avon- mouth Dock, Bristol, England, page engraving.—Building of a Remark- able Lighthouse, France.—New and Powerful Armstrong Gun.—A Cheap Farm Bridge: general description, dimensions, and particulars, with 2 pages of drawings, covering illustrations of all the details, for a bridge of 100 feet span or less; specially useful for crossing of creeks, small rivers, gullies, or wherever a costly structure is not desirable. The drawings are from the Spar Bridge exhibited at the Centennial, in the U. S. Department of Military Engineering.—Iron and Steel. By Dr. C. W. MICHES. A most interesting and valuable paper, contain- ing accounts of the most recent practical improvements in the Pro- duction, Working, and Application of Iron and Steel; embracing the ques- tion of Labor in its relation to Capital; the Character, Value, Cost, and Production of the various kinds of Fuel, including Bituminous Coals, Coke, American Fuels, Peat, Natural Gas Fuel, Artificial Gas Fuel, Liquid Fuel, Solar Fuel. Motive Powers and their Transmission over long distances. Power, its Transmission by Steel Ropes; its Transmission by Electricity. Wind Power. Bessemer Steel History. Stemens and Martin Steel. The Regenerative Furnace. The Open- Hearth System. The Use of Ferro-Manganese. Use of Chromium. Production of Mild Steel. Piping of Steel. The Applications of Steel. Iron and Steel Nomenclature. Wrought Iron. Mechanical Puddling. Bell's New Process. Wrought Iron Direct from the ore. Methods of Protecting Iron and Steel from Rust. Ainslie's Method. Bart's Method.
II. ELECTRICITY, LIGHT, HEAT, ETC.—Stratification of the Electric Discharge in Vacuum Tubes.—Mance's method of determining Electric Intensity.—New method of determining the melting points of metals by electrical apparatus.—A New Mercury.—Bichromate Battery, effec- tive and economical, with 2 illustrations.—Electrical Time Ball. Electrical Conductivity in Liquids.—Rotary Magnetic Polarization.—Thermo- Currents in an Electrolyte. Accidental or Subjective Colors.
III. CHEMISTRY, ETC.—The Adulteration of Milk. By HENRY A. MOTT. Jr., 4 illustrations.—Analysis and Composition of the Sweet Potato.— Atomic Weight of Selenium. Moss Copper. By W. M. HUTCHINGS. Connection Currents.—The Photographic Image.—New Method of Producing Nitrogen. By J. W. GATHOUSE.—Increase of Weight by Combustion. By J. W. German Chemical Society, Berlin. Notices of a large number of papers by distinguished chemists. Meeting of the Chemical Society, London. Zinc Copper Complex.—Chromium Pig Iron.—Estimation of Bismuth.
IV. MISCELLANEOUS.—Vibrations of Cylindrical Rods.—Manometers.— Exploring Balloons for Meteorological Purposes.—Radiometer.—What is Bathytherm? The Eyes of a Fish.—A Live Anemone.—Separat- ing of Cocoon Threads.—Cachou de Laval, the new patent color.

Terms.—SCIENTIFIC AMERICAN SUPPLEMENT, one year, postpaid, five
dollars. One copy of SCIENTIFIC AMERICAN and one copy of SCIENTIFIC
AMERICAN SUPPLEMENT, one year, postpaid, seven dollars. CLUBS.—One
five copies of SUPPLEMENT will be supplied gratis for every club of
All the back numbers of the SUPPLEMENT, from the commencement, Jan-
uary 1, 1875, can be had. Price 10 cents each.

NOW READY.—THE SCIENTIFIC AMERICAN SUPPLEMENT for 1876.
Complete in two large volumes. Over 800 quarto pages; over 3,000 engrav-
ings. Embracing History of the Centennial Exhibition. New Illustrated
Instructions in Mechanical Drawing. Many valuable papers, etc. Price
five dollars for the two volumes, stitched in paper; or six dollars and fifty
cents, handsomely bound in stiff covers.

Remit by postal order. Address
MUNN & CO., PUBLISHERS,
37 Park Row, New York.
Single copies of any desired number of the SUPPLEMENT sent to any
address on receipt of 10 cents.

LANDS BELOW THE OCEAN LEVEL.

In an article treating on some remarkable results of evapo-
ration and rainfall, published on page 257 of our issue of
April 28, this year, we described one of the instances of the
great excesses of evaporation over rainfall, namely, the Cas-
pian Sea, of which the surface is as much below the ocean
level as our Lake Champlain is above the same, namely, more
than 80 feet. There are, however, two still more remarkable
cases of the same sort, the Dead Sea in Palestine and the
Great Desert of Sahara in Africa. The former is remarkable
for the great amount of the depression, and the latter for the
immense surface depressed, being in fact the bottom of an
extensive inland lake, totally dried up by the heat of a tropi-
cal climate, aided by the absence of feeding streams, and by
the rainless area which covers its greatest portion. It is, on
an average, 80 feet below the ocean, about as much as the
Caspian Sea; but it is remarkable for its extent, being nearly
2,000 miles square, or nearly 4,000,000 square miles.

The French government, having an eye to the colonization
of Northern Africa, with Algiers as a starting point, has for
some time favored a project for restoring this sandy waste to
its primeval condition by cutting a communication with the
ocean, and so transforming it into a salt water inland
lake. The effect of this on the climate of the surrounding
country, and especially on the colony of Algiers, would un-
doubtedly be most beneficial, because the south wind, in-
stead of blowing, as it does now, over a sandy desert, would
become a sea breeze: this would increase the rainfall, and
change a rainless district into a fruitful region. In a com-
mercial point of view, moreover, the benefits of such a change
could not be overestimated. The introduction of water trans-
portation is especially advisable in this tropical region, where
the miserable and utterly inefficient caravan is now the only
mode of carrying goods; and without doubt commercial cities
would soon spring up around the shores of the proposed in-
land sea, which would become the scene of a mighty travel
and traffic, as the lake would give easy access to the sur-
rounding countries, and develop this part of Africa to an
extent thus far utterly undreamed of.

But it is well to look also at the disadvantages of this
gigantic scheme. In the first place, it will rob the ocean of
such an enormous amount of water that its general surface
will be lowered to an appreciable extent. In order to realize
how much this lowering will amount to, let us consider that
the total terrestrial surface is, in round numbers, 200,000,000
square miles, of which the ocean occupies three quarters, or
150,000,000. If the estimate given of the Desert of Sahara,
4,000,000 square miles, is correct, it occupies $\frac{1}{50}$ part of the
ocean's surface, and, therefore, every foot of depth of water
abstracted for the Desert will diminish the ocean $\frac{1}{50}$ part of
a foot; and the withdrawal of water for a lake 80 feet deep
would leave the ocean level $80 \times \frac{1}{50}$, or more than two feet
lower, which would be plainly perceptible in the many harbors
where careful tidal observations are made, and in some cases
changes may influence the shipping, robbing as it would do
all parts of the world of over two feet depth of water, which
would be very bad in those localities where the harbors are
shallow.

This much as to an immediate result; but the ultimate
consequences would be much more serious. It should be
considered that this large inland lake, if once established,
would have no fresh water supply, by rivers; but the sea
water would certainly rush in through the channel, to make
up for the large evaporation, which we may safely set down
at 1,200 lbs. of water per year for every square foot. This
would lower the level 20 feet per year, which is one quarter
of the whole quantity of the lake. This, for a surface of
4,000,000 square miles, or 100,000,000,000 square feet,
gives 2,000,000,000,000 cubic feet of water to be replaced
annually from the ocean, or nearly 6,000,000,000,000 cubic
feet per day, or 250,000,000,000 cubic feet per hour, or 4,166,-
666,666 cubic feet per minute, or 69,444,444 cubic feet or
525,000,000 gallons per second. As the German Rhine car-
ries only 1,000,000 gallons of water per second, on an aver-
age, the channel bringing the supply to the Desert of Sahara
from the ocean would have to carry as much water as is car-
ried by 525 rivers like the Rhine; and from the salt water
only pure water would be evaporated, leaving the salt be-
hind. As this amounts to 4 per cent, or $\frac{1}{25}$ of the sea water,
and as nearly 20 feet deep, or $\frac{1}{4}$ of the water in this new lake,
would annually evaporate, it would only take 4×25 , or 100
years, one single century, for all the water to disappear, and
a deposit of salt take its place. Then the now sandy desert
would be changed into a desert of salt: which salt would fill
the whole basin, and would certainly be a more serious af-
fliction to Algeria than the present sand plain can possibly be.

THE THORNEYCROFT FAST LAUNCHES.

In a recent description of the French torpedo experi-
ments at Cherbourg, we noted the wonderful speed of nearly
19 knots per hour attained by a steel torpedo launch built by
Messrs. Thorneycroft. In such small craft, displacing at
most but about 15 tons, this extreme velocity appears to be
obtainable only over short periods; but a speed of 18 knots
has been maintained over measured distances for more than
two consecutive hours, the engine then developing 220 horse
power. The dimensions of a launch which attained this
speed are as follows: Length 63.04 feet, beam 8.53 feet,
draught of water (average) 2 feet, displacement (that is to
say, the total weight of the vessel and all its contents) 15
tons.

While there can be no question but that these vessels de-

monstrate remarkable progress in navigation, on the other
hand this achievement cannot be attributed to any new dis-
covery, but results from improved application of known
principles, and especially from the rare perfection of the con-
struction of the motive apparatus, which develops great power,
while its weight is reduced to the narrowest limits. This,
however, is not the only element of success. The model of
the hull is such as to diminish to the utmost the liquid resist-
ance opposed to its onward movement. Again, the material
of which the hull is built is such as not to absorb by its
weight a fraction of the total displacement which may be
usefully devoted to the motive machinery. To this end it is
built of steel plates, and weighs but 9,900 lbs., or less than a
third of the total displacement. In order that the propeller
should afford the maximum effect, it is necessary that the
liquid vein upon which it acts should be as large as possible
in comparison with the resistant section of the vessel. Or-
dinarily the section of vein acted upon is less than the latter.
In the Thorneycroft launch, the screw shaft is placed on a
level with the keel, instead of being located at a point half
way between the keel and the water line, as is usually the
case. The screw then projects below the keel for nearly
half its diameter, and consequently it acts upon a section of
vein greater in area than the greatest section of the vessel.
This arrangement doubtless contributes materially to the
speed; while a sharp bend of the keel protects the propeller
from damage.

As already noted, Messrs. Thorneycroft's success in pro-
ducing a motor both light and powerful has been remarka-
ble. The complete machine—that is, including boilers and
the water contained—weighs in all 16,060 lbs. The power
at the speed of 18½ knots having been 220 horse, the weight
is therefore but 72.6 lbs. per horse power. The machinery is
therefore probably the lightest ever produced for purposes
of navigation. Large marine engines for a long time rarely
weighed less than 440 lbs. per horse power; and it is only
through recent improvements that this has been reduced to
330 lbs. For ordinary launches, with non-condensing en-
gines running at high velocities, the usual weight per horse
power is about 220 lbs. It is therefore interesting to note
under what conditions Messrs. Thorneycroft's engines are
produced. They are condensing machines, two cylinder, on
the compound system. The boilers are of the locomotive
type, with the difference that the tubular surface is reduced
about one half. This is the only sacrifice which has been
made for the economic production of power; and it was ne-
cessary in order to reduce the weight of the apparatus. The
safety valves are loaded to 13.2 lbs. The engine makes 430
revolutions per minute, which requires great mechanical ex-
cellence of the mechanism, and especially of the air pump.
The consumption of coal per horse power per hour is 3.53
lbs. The grate surface is 11.19 square feet. An artificial
blast is conducted directly to the fire chamber instead of to
the ashpit.

THE PERMANENT SUPPLY WATER WORKS OF BALTIMORE.

One of the greatest engineering works now in progress is
that to supply the city of Baltimore with water, and the gen-
tlemen in charge of it have been so busy pushing it forward
that they have had very little time to talk about it: in conse-
quence of which not many people outside of the city know
anything of it, and comparatively few have any idea of
the immensity and difficulty of the works that are now so
quietly progressing to supply them with an almost unlimited
supply of the necessary article of water. One of our cor-
respondents lately called on Mr. Robert K. Martin, the en-
gineer in charge, who was so obliging as to show him over
the line of works, and we are thus enabled to lay the follow-
ing particulars before our readers.

Baltimore is at present supplied with works having a ca-
pacity of about 15,000,000 gallons a day, which comes from
Jones' Falls to Lake Roland, whence it is brought by a con-
duit 3½ miles long to Hampden reservoir and Druid Lake.
From the latter, which is 53 acres in extent and 217 feet
above tide, one portion of the water is raised by power-
ful steam pumps to a high service reservoir 350 feet above
tide, for supplying the highest region of the city; a second
part is supplied direct to the mains; and still another portion
is allowed to pass to Mount Royal reservoir, which is only 150
feet above tide, so as not to give too high a pressure to the
lowest portion of the city.

This supply having been found to be insufficient in the
summer season, it was resolved to increase it temporarily by
erecting, near the Gunpowder River, a pair of Worthington's
duplex compound pumping engines, capable of raising
10,000,000 gallons a day from that river, over a hill 265 feet
high, to Roland Run, a tributary of Jones' Falls above men-
tioned. This arrangement, however, was not sufficient for
some of the more enterprising of the Baltimoreans, and a
new plan was devised; and it is now being carried out, not-
withstanding considerable opposition by interested parties,
by the capable and energetic civil engineer of the Water
Commission, Mr. R. K. Martin, who had charge of the pre-
vious works, erected in 1858. The source of the new supply
is the Gunpowder River, which at about nine miles from Bal-
timore makes its nearest approach to the city, as at this point
it takes a bend in another direction. Advantage is taken of
this turn to form a dam across the stream, and so form a
storage lake which will, it is believed, be capable of supply-
ing the city with 175,000,000 gallons of water every twenty-
four hours. This lake will be from 500 to 1,000 feet wide,
about 20 feet deep on the average, and will extend up

the Gunpowder a distance of about 5 miles through the most picturesque scenery, which is constantly changing, as the river and the valley through which it runs pursue a very devious course between ranges of precipitous, wooded hills, from where it leaves the open country near Meredith's Ford bridge, which forms the head of the lake. To facilitate operations, a road 10 miles long, about 30 feet wide, and about 10 above the intended level of the lake, has been cut in the sides of the hills on each side, which will no doubt be utilized hereafter as a pleasure drive by the lovers of beautiful scenery.

At the lower end of the site chosen for the lake, two hills jut out into the valley, leaving but a comparatively narrow place, of which advantage is taken to form a dam which will raise the water about twenty feet above the natural level of the river. In one of these hills is the mouth of the tunnel, hereafter referred to, from the side of which a dam will be built having an overfall of 300 feet and a wing of 190 feet, that will extend into the opposite hill. This dam will be of the most substantial character, of heavy stone laid in hydraulic cement. The stone work will be 31 feet high and about 65 at the base, having its foundation on the solid rock; and it is estimated that about 20,000 perches of stone will be required for this part alone. The face of the overfall will be built of large blocks from three to four feet in depth; and to prevent any undermining, an apron is to be cut below the overfall resting four feet below any of the other foundations. The other side of the dam will be protected by a backing of 165 feet of puddle clay, gravel, and riprapping. The parapet walls will rise 12 feet above the overfall, and will be level with the floor of a gate house that is to be erected at the tunnel end of the dam. At the gate house begins the tunnel, which is to carry the water to Lake Montebello. This tunnel is nearly seven miles long—36,510 feet—and is therefore the longest in the country. The bore is circular in shape and is 12 feet in diameter. Over five miles of it will be through hard gneiss, which is being cut with drills driven by manual labor, as the contractors think that, owing to the comparatively small area of the tunnel, the power drills are not economical enough to pay them for the cost of the necessary machinery. A portion of the tunnel is being cut through softer material—a kind of limestone, that crumbles into powder by the force of the explosion when blasted. This part of the tunnel will have to be bricked; but where the gneiss occurs, the brickwork will be dispensed with, except in some localities where there are bad breaks and crevices in the rock, and at the bottoms of the shafts which will, when the tunnel is completed, be arched over with masonry 6 feet thick, to withstand the immense pressure of the loose earth filled in above.

To facilitate the operations in the tunnel, fifteen shafts, from 65 to 300 feet deep, have been sunk, most of which are down to grade; and in some of them considerable work has been done on the tunnel. But owing to the hardness of the rock for the larger portion of the distance, very fast progress cannot be made—only about a running foot of tunnel per shift of 12 hours, or two feet per day, as in tunneling night and day are alike so far as work is concerned, the only light in either case being that obtained from the small lamps attached to the miners' hats. As before stated, the contractors employ manual power for drilling, which, in the hard work, is done by task work—thirteen feet per shift being the miner's task. The holes are bored 30 inches deep, and an eight ounce cartridge of giant powder (nitro-glycerin and sawdust) is used in each hole, at which rate about 7 lbs. of powder, at 40 cents per lb., is used for each running foot of hard rock tunnel, making for the five miles through the gneiss nearly \$74,000 for explosives alone, to say nothing of that used in the other portions of the work.

The shafts are from 8 x 17 to 8 x 20 feet inside the timber work, which, when used, adds about 30 inches to the above figures; and as fast as they are completed they are fitted with improved safety cages to prevent accidents from the hoisting mechanism; but they have only the ordinary tipping bucket until the shaft is down to grade. The exhaust from hoisting engines is utilized to create a draught in a pipe, the mouth of which is near the heading, and by this means ventilation is secured in the tunnel.

In the limestone portion of the tunnel, between shafts 1 and 2, the stratum makes an eccentric dip, leaving a "pocket" of mud which, as the miners were working towards it, suddenly ran into the tunnel, overwhelming and suffocating one poor fellow who had been driven by it against the timbers; but the remainder of the workmen managed to escape. In this, as in some other sections, the water forms a great hindrance to operations, a spring being found here which keeps a steam pump of a capacity of 200 gallons a minute constantly at work, while about the same quantity of water percolates through other crevices in the rocky sides of this section of the tunnel and has to be removed by another pump of the same size. The same trouble occurs in other shafts, especially No. 5.

To make the necessary observations required to properly line and level the tunnel, a straight line has been made over the tops of the hills and through the woods, and three observatories have been erected for this purpose. As an instance of the great care taken by Mr. Martin in this matter, it may be stated that these structures are double, consisting of an inner tower (on which the instruments are placed) protected from atmospheric and other influences by an outer one, entirely detached from the other, on which the engineer stands when making his observations.

At the lower end of the tunnel is to be located a reservoir,

to be known as Lake Montebello, which is being formed by damming up a valley admirably suited to the use to which it is being put. The upper and lower ends of the valley, forming the east and west sides of the reservoir, will be closed up with dams of stone and earth, 450 feet wide at the base and 100 feet at the top, with each end imbedded in the hills at the sides, so that the greatest possible strength may be obtained; for this is one of the most critical pieces of construction along the whole line, as these dams will have to sustain the pressure of 600,000,000 gallons of water. The north and south sides of the valley, about 3,500 feet each, will form the other sides of the reservoir, which, when completed, will have the appearance of a natural lake, and will have a superficial area of about 80 acres and a depth of at least 30 feet. The sides will be finished with riprapping, and the top will be surrounded by a fine road $1\frac{1}{2}$ miles long and from 60 to 80 feet wide, divided from the reservoir by a neat and substantial iron fence.

There being a stream running through this valley whose water is too impure to be used, a drainage tunnel, 2,870 feet long and of 9 feet diameter, had to be made to carry it away, which tunnel will also serve to take off the surface drainage, and to empty the reservoir, should it be required. From this reservoir, another tunnel, 2,600 feet in length and 12 feet in diameter, is now in course of construction. This tunnel is cut through soft material, and therefore requires strengthening with brickwork laid in hydraulic cement. Where the tunnel is of the right character, the top arch is three bricks thick and the invert below the spring line two bricks, with a proportionate backing of from 18 to 24 inches above the spring line, built in against the timbers or the rock wall of the tunnel. In the soft places, there is an additional ring of brickwork added, and the backing is proportionately increased. In all cases, the arch is packed over the top with clay well rammed in. The brickwork in this, as in the main and drainage tunnels, requires to be done with the greatest care, as it has to stand not only the outside pressure of the immense weight of material above it, as in railroad tunnels, but also the internal pressure of the water within, which is always searching for weak spots to break through, and it is therefore being done by the day. It is estimated that about 12,000,000 bricks will be used in all the tunnels.

One portion of this tunnel passes beneath a well, the bottom of which is only four feet from the top of the tunnel; and yet the water of the well has not been drained, and it continues to furnish its usual quantity of water, notwithstanding that another well, 300 feet from the tunnel, was almost immediately drained and has now no water whatever.

At the end of this tunnel will be a gate house from which the water will pass into six pipes of 48 inches diameter each, by which it will be conveyed to the city limits, and there connected with the present system of mains for distribution throughout the city.

Along the line of the work have sprung into being several temporary villages for the miners and laborers, showing styles of architecture that one would hardly expect to find so near a great city, varying from the tolerably comfortable offices of the contractors to that of the squalid log huts of the negro laborers on the storage lake, with a single room that is half below ground and half above. Many drinking shops have also been built on the line, or rather as near to it as they can be built (for the engineer will not allow them on the city property), in which the men squander their hard earnings after each pay day, and so unfit themselves for their labor as to cause no small delay to the progress of the work.

Unlike the officials of some other cities that may be named, those of Baltimore appear to have a fashion of completing their public works without exceeding the appropriations for them. This was the case with their city hall, inaugurated a year or two ago, and it appears as if it would be the same with the water works. The whole amount appropriated for this purpose is \$4,000,000; but the engineer in charge, who is doing his best to cut down the expenses all he can without depreciating the quality of the work, thinks the whole improvement can be completed at a cost of very little, if any, over \$3,000,000. About 1,500 men are employed—common laborers getting \$1.25 per day and miners \$1.50. It is expected that the whole work will take about three years to finish, and Baltimore will then have a natural flow through the tunnel that will supply it for generations to come with all the water for ordinary purposes that can be used or wasted, as the river at the point tapped is 170 feet above mean tide, and consequently will give water to nearly all the houses in the city, except in the extreme northwest section, for which the water will still have to be pumped into a high service reservoir.

Mr. Martin is assisted by Mr. C. P. Manning, consulting engineer, W. L. Kenley, chief assistant, and seven resident engineers, Messrs. R. B. Hook, W. R. Warfield, C. O. Swan, C. T. Manning, O. H. Balderston, and C. A. Hook, who are named in the order of the work they have in charge, beginning at the storage lake. The contractors, also named in the same order, are Messrs. Condon and Co., Fenton and Allan, Bruce and Patterson, L. B. McCabe and Brother, J. Donohue and Brother, and J. E. Eschback.

From this cursory sketch, some idea of the magnitude of the work in which the city of Baltimore is engaged may be obtained—a work alike honorable to the public spirit of her citizens and the gentlemen engaged in its construction.

THE most valuable part of a man's education is that which he receives from himself.

WHAT IS A TEMPORARY STAR?

On November 24, 1876, Professor Schmidt, Director of the Observatory at Athens, Greece, noticed a new star, of the third magnitude, in the constellation *Ophiuchus*. The three nights immediately preceding had been cloudy, but the star had not become visible on the night of the 20th. Astronomers throughout the world were at once notified of the discovery, and the object was diligently observed both in Europe and America. Its apparent magnitude very rapidly diminished from the date of its discovery. In a few weeks it became invisible to the naked eye; and in less than three months its light was no greater than that of a star of the ninth or tenth magnitude. Other instances of such phenomena are well known in the records of astronomy. The following catalogue, with the exception of the last two, is given by Humboldt:

No.	Date.	Position.	Duration of visibility.
1. July,	134 A.D.,	in <i>Scorpio</i> .	Doubtful.
2. Dec.,	123 A.D.,	in <i>Ophiuchus</i>	"
3. Dec. 10, 173	"	in <i>Centaurus</i>	8 months.
4. March,	369 "	Doubtful	6 "
5. April,	386 "	in <i>Sagittarius</i>	3 "
6.	389 "	in <i>Aquila</i>	3 weeks.
7. March,	393 "	in <i>Scorpio</i>	Doubtful.
8.	827 "(?)	in <i>Scorpio</i>	4 months.
9.	945 "	near <i>Cassiopeia</i>	Doubtful.
10. May,	1012 "	in <i>Aries</i>	3 months.
11. July,	1203 "	in <i>Scorpio</i>	Doubtful.
12. Dec.,	1230 "	in <i>Ophiuchus</i>	3 months.
13.	1264 "	near <i>Cassiopeia</i>	Doubtful.
14. Nov. 11, 1572	"	in <i>Cassiopeia</i>	17 months.
15.	1578 "	Doubtful	Doubtful.
16. July 1, 1584	"	in <i>Scorpio</i>	"
17. Oct. 10, 1604	"	in <i>Ophiuchus</i>	17 months.
18.	1609 "	Doubtful	Doubtful.
19. June 20, 1670	"	in <i>Vulpecula</i>	20 months.
20. April 28, 1848	"	in <i>Ophiuchus</i>	Doubtful.
21. May 12, 1866	"	in <i>Corona Borealis</i>	"
22. Nov. 24, 1876	"	in <i>Ophiuchus</i>	"

"It is worthy of especial notice," Sir John Herschel remarks, "that all the stars of this kind on record, of which the places are distinctly indicated, have occurred, without exception, in or close upon the borders of the Milky Way, and that only within the following semicircle, the preceding having offered no example of the kind." The striking fact here noticed indicates the existence of unknown physical conditions in this portion of the heavens, favorable to the production of the phenomena described.

Again, while two or three of the recent temporary stars have remained visible as small telescopic objects of somewhat variable brightness, yet in no case has an outburst occurred in precisely the same locality with a previous one. The supposed identity of the stars of 945, 1264, and 1572, cannot therefore be sustained, and the assumption that "all the temporary stars are simply variable stars" of long period is wholly destitute of support.

CAN THE PHENOMENA BE EXPLAINED WITHOUT THE ASSUMPTION OF AN UNKNOWN CAUSE?

It is a remarkable feature of the binary systems among the fixed stars that the orbits have great eccentricity, the less component in its periastron passage coming into very close proximity to the greater. This approach, in several known instances, is within less than the earth's distance from the sun, and, in at least one case, less than that of Mercury. Among the large and increasing number of known systems whose elements have not been determined there are probably some of still greater eccentricity. If we suppose in such case that the principal star is still in a gaseous condition, and that the radius of its atmosphere is greater than the periastron distance of its companion, the latter will at each return, by plunging through this atmosphere, produce an increased degree of light and heat. Its period will become shorter at each successive return, until it shall be arrested by penetrating the denser strata of the principal star. Its orbital motion will thus be converted into heat and the phenomena of a new or temporary star may be presented to distant spectators. Such collisions as we have supposed must have occurred very frequently in the solar system when the sun's diameter was much greater than at present, as comets of small perihelion distance would be absorbed by the central mass.

"The circumstance," says Humboldt, "that almost all these new stars burst forth at once with extreme brilliancy, as stars of the first magnitude, and even with still stronger scintillation, and that they do not appear, at least to the naked eye, to increase gradually in brightness is, in my opinion, a singular peculiarity, and one well deserving of consideration." The fact here stated is in manifest harmony with the theory above proposed. It is worthy of note, moreover, that the part of the heavens in which the outbursts have occurred is rich in double stars and sidereal clusters.

Bloomington, Ind.

DANIEL KIRKWOOD.

A Simple Fire Escape.

J. R. M. writes to suggest that a piece of stout canvas, about 20 feet square, with hand loops all around it, could be held in the hands of a few men under the windows of a burning house. Persons could then jump from the windows with safety, especially if the handles were attached to the canvas with rubber or wire springs, which would give elasticity to the canvas, and break the fall of the person jumping from the window.

THE MANUFACTURE OF SILVERWARE.

There are certain industries which grade so insensibly into the fine arts that, in referring to those who follow them, one scarcely knows whether to use the terms workmen or artists. The manufacture of jewelry is one of these callings, that of silverware is another. The casual looker-on, seeing men with metal tools and hammers in their hands, bending over their benches, working at some dull-looking metal, instinctively regards them as mere manual laborers engaged upon no arduous task; but if he glances over their shoulders, and sees the ductile metal under their manipulation assume the most exquisite shapes, if he witnesses work produced not only of marvelous delicacy, but bearing the imprint of genius in every detail, the simple tools and begrimed garb of the workers are noticed no longer, and a feeling of genuine admiration comes uppermost in the mind capable of appreciating true artistic skill. Silver

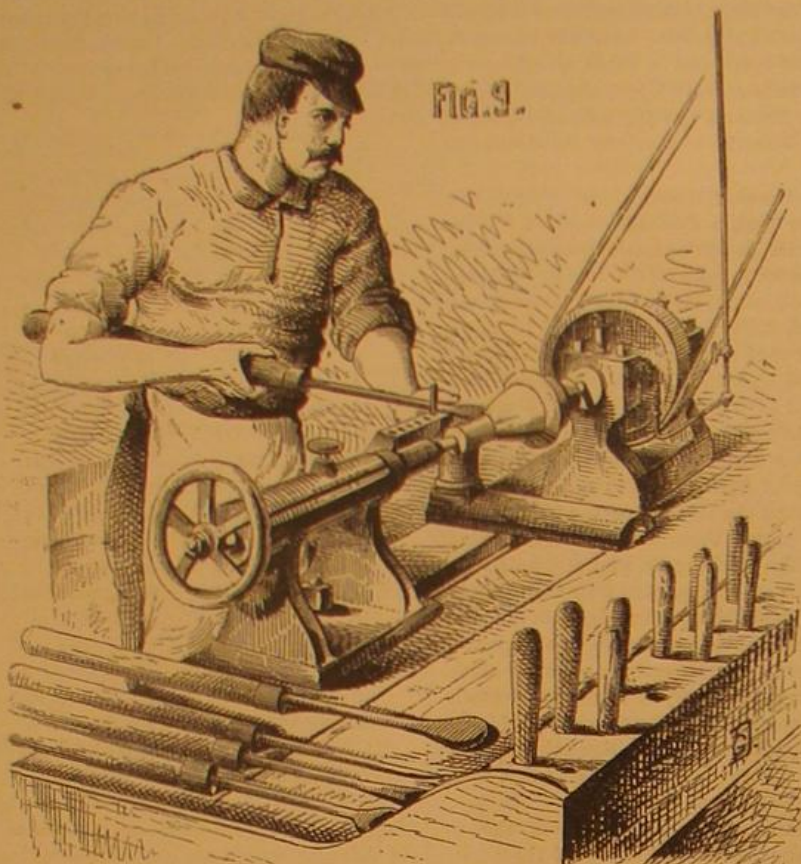
working has its prosaic side; for, despite beautiful ornamentation, forks and spoons are the commonest of every-day articles, and teapots, as teapots, are not conducive to lofty reflections. But on the other hand, such homely objects tend to make the industry what it is—art-workmanship, or to render it a link between the ideal and the actual, a means of adaptation of the airy conceptions of the artist to forms of utility. The manufacture of silverware may be divided into two parts: first, such as relates to the production of forks, spoons, and like small objects of definite form; and secondly, that relating to the making of hollow ware, which includes vessels of every description, whether for use or ornament. We propose in the following article to trace the various processes as practised at the largest establishment devoted to such work in the country—that of the well known firm of Tiffany & Co., of this city.

The silver, to fit it for use, is alloyed with copper in the proportion of 0.075 copper to 0.925 of silver. The metal, on its reception at the factory, is weighed and tested to determine its standard quality, and is then sent to the melting hearth to be run into ingots of proper size. The operation of melting is represented in Fig. 1. (See front page.) The charge in each crucible is from 400 to 450 ozs., which, on becoming fused, is poured into either a skillet mold or else run into bars. The skillet is an ingot about 10 inches long by 6 inches broad, and $1\frac{1}{4}$ inches thick, and is used for making the plates subsequently spun into hollow ware. The bars from which spoons, etc., are produced are some 20 inches in length, $1\frac{1}{4}$ inches in width, and $\frac{1}{4}$ inch thick. As in these two forms of the metal are the starting points respectively of the two departments of the manufacture above noted, we shall trace the operations upon each separately, beginning with

THE MAKING OF FORKS AND SPOONS.

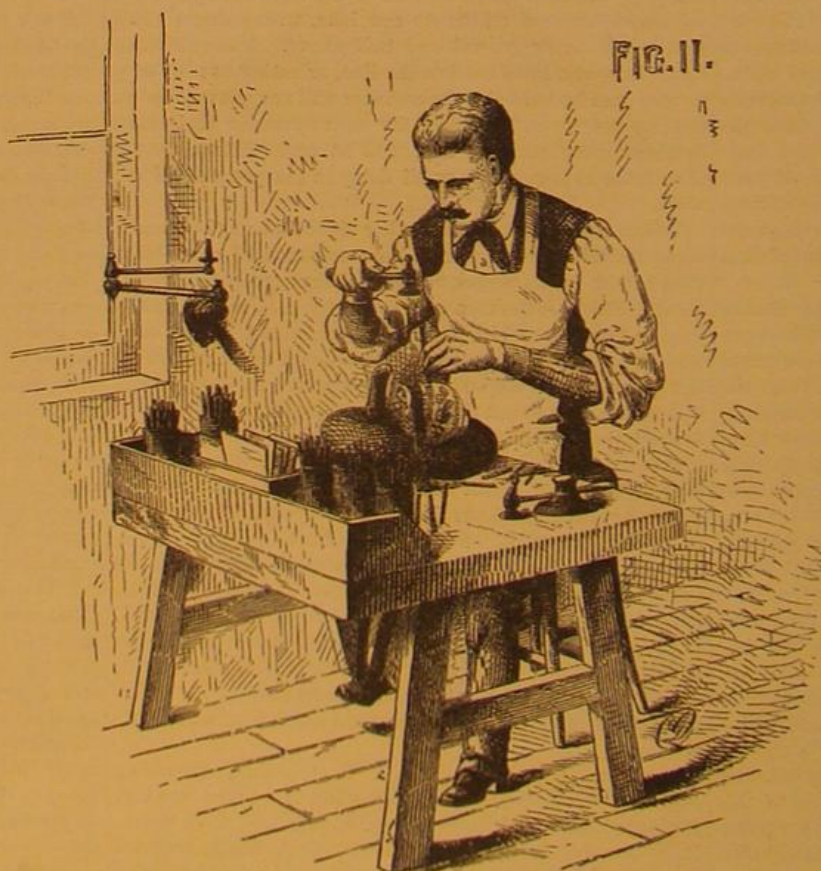
The bar of silver alloy above mentioned is placed between heavy rolls (Fig. 2, front page) and flattened out to $\frac{1}{4}$ inch in thickness. Ponderous shears then cut it into suitable lengths for the individual articles to be produced; and then rolling in a transverse direction flattens that portion which is to form the bowl of the spoon or tines of the fork, until at such part the width is about $2\frac{1}{4}$ inches. The blank, as it is termed, is now of the shape of A (Fig. 3, front page). It is then placed in dies in a drop press; and on the fall of the hammer, it emerges in the shape shown at B in the same figure. Next follows the rolling; and this involves the use of one of the most expensive machines employed. The outlay is incurred in the manufacture of the steel rolls, a pair of which is shown in Fig. 4 (see front page).

On a single pair may be cut stamps for seven different articles. Thus we found the necessary patterns for dessert, table, tea, salt, and mustard spoons, besides those for large and small forks, on the two rolls represented, which, though quite small in size, cost about a thousand dollars to engrave. The designs are cut directly upon the cylindrical surface, and the metal is subsequently case-hardened. In operating the machine, the rolls are set in motion, and the workman inserts blanks for the articles desired, as the respective dies



THE SPINNER AT WORK.

rotate in front of him. As the metal enters the rolls, it is caught by the deep notches made beside the pattern, and is thus prevented from slipping. On emerging, a spoon blank appears as in Fig. 5 (see front page). The pattern is perfectly stamped; but the bowl is flat, and around the spoon now outlined is a large amount of superfluous metal, which is clipped off by hand shears, the pieces falling into a locked box. Then the blank is carried to a file wheel, which removes all the material close up to the edge of the pattern; and if a fork is being made, a rotary file cuts the spaces between the tines.

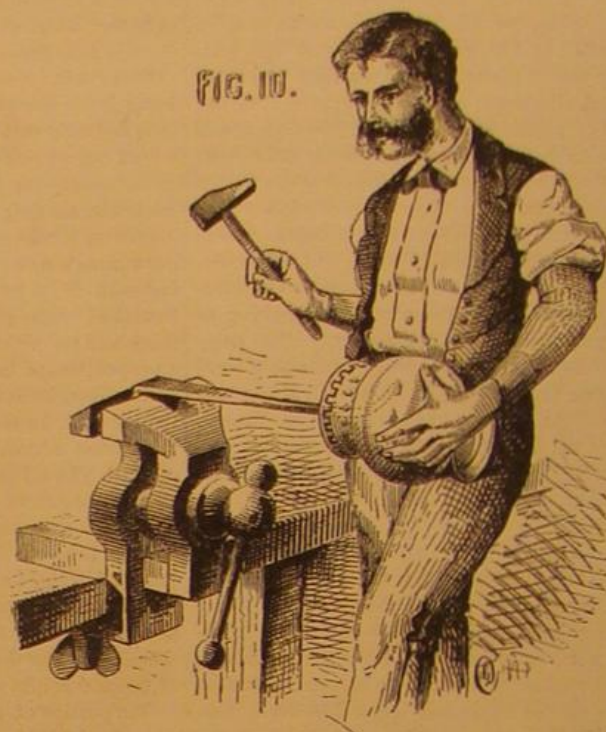


REPOUSSE WORK.—CHASING.

The next operation is forming the bowls of spoons or the curved portions of other objects. This is done under the drop press by steel stamps, which force the portions to be curved into matrices made of tin. This metal is used because it is softer than the silver alloy, and yields to the raised portion of the ornamentation on the under side of the object as the blow is delivered. If the matrix were of steel, the ornament

would, of course, be flattened out. The operation of drop pressing is shown in Fig. 6 (see front page). At A, a tin die for a spoon is separately exhibited.

The proper curve to the handle of the spoon is imparted by setting with a wooden mallet. Then follows smooth filing and weighing of the objects previous to their polishing. As a rule, about one third the metal in the original piece cut from the bar remains in the spoon; and during the various operations detailed, the absolute waste of material rarely exceeds 3 per cent. Nothing further is necessary but the buffing and polishing, which is done on wheels rotating at about 2,000 revolutions per minute, oil and sand being first used and then ordinary rouge powder. Fig. 7 (see front page) represents the polishing room. Meanwhile the elegant boxes,



REPOUSSE WORK.—SNARLING.

satins-lined and Russia-leather-covered, are being prepared from copper models of the objects which they are to contain; and in these receptacles, the gracefully shaped articles, dazzling in their fresh polish, repose in the sales-rooms of the iron palace on Union Square.

We may now retrace our steps back to the murky basement where the silver is melted and rolled, and thence follow the skillets in their final manufacture into hollow ware.

THE MANUFACTURE OF SILVER HOLLOW WARE.

Each skillet is passed some twenty times through the heavy 24 inch face rolls before mentioned (Fig. 2, front page), until it is reduced to a thickness indicated by 26 wire gauge (Brown and Sharpe's). Meanwhile the designers have produced detail drawings of the object to be manufactured, a pitcher, for example, of the form shown in Fig. 8 (front page). With the plate before him, a workman marks on the silver the lines laid down in the drawing, and, following them, rapidly cuts out the object. Our pitcher is now an assemblage of disks. Two, which answer to the upper and lower hemispheres of the lower portion; another forms the cover, and still another is to be made into the slightly flared straight intermediate portion. Then there are two narrow strips from which the ornamental bands are to be made. The decorative object on the cover and the handle are not provided for; but these we shall refer to further on.

The materials which are to be rendered concave are sent to a spinner, who has before him the drawing and a wooden pattern of the shape of the desired bowl. He pinches a disk in the fixed center screw of his lathe between two flat surfaces of wood, one of which is the wooden pattern. A burnisher resting against a pin in the lathe rest is now applied near the center of the metal, and the latter is gradually but rapidly bent or arranged until it fits close against the curved face of the block. The spinner at his work is represented in Fig. 9. The disks which are to form the upper part of the pitcher, globe, and also the cover, are treated in a similar manner, and the square-shaped pieces are flared by a similar process. While this is in progress, the narrow strips which are to form the ornamental bands are passed between engraved rolls, which impress upon them a suitable pattern. Their ends are soldered together, and they are bent around formers which give them the requisite flaring shape. Now the various parts of the pitcher being completed, nothing remains but to solder them neatly together, and the vessel assumes its desired form.

The handle and ornament for the cover, having been moulded in wax, and clay moulds prepared, are cast, an operation of the greatest delicacy, inasmuch as there is an immense amount of intricate undercutting work to look after. The moulds are made in fragments of every possible shape, and all are numbered so that they can be readily put together. At this stage, the handle and cover being affixed, our pitcher

may be deemed complete. That is, it may be buffed and polished, and we should have a handsome plain article with a little tasty ornamentation on handle, cover, and on the fillets. If, instead of a pitcher, we had selected a snuff-box or waiter as our example, the spinning process would of course have been omitted, and the bent portions, forming the *hange* (or bulge) of the waiter or sides of the snuff-box, would have been hammered over formers. No matter what the article is, however, the manufacture might as stated end here; but should we require an elegantly decorated object, we step at this point out of the region of handiwork and at once enter the realm of fine art.

HOW SILVER IS DECORATED.

We shall now proceed to explain the various ways in which our pitcher might be ornamented, and of these the simplest is the satin finish. This is done by a patented implement, small in itself, but, like a great many other little articles, very important in the office it performs. The object, having been polished, is held against a revolving bunch of fine brass wires, the latter being loosely held to the hub of a wheel. A stream of soapy water runs down on the brush while it is in revolution. The silver, being held up to the moving wires, is thus covered with minute scratches which finally produce upon the surface the soft sheen of satin. This is one of the most beautiful finishes that the metal can receive, and the rapidity with which it is done is remarkable.

Still more ornate is the flat chasing. By this process, tasteful figures are produced on the silver by dots and lines made with a punching tool. No metal is cut away; and in this respect the operation differs from engraving, in which sharp cutting gravers are employed to produce the design in sunken lines. *Appliqué* work is just the reverse of the foregoing, as the ornaments, instead of being made by indenting or removing the metal, are added by affixing portions to the surface. The metal is previously rolled or stamped into figures, scrolls, or braids, and these are simply soldered on the object to be ornamented. When finished, silverware in *appliqué* resembles that decorated by the *repoussé* process, which forms the subject of Figs. 10 and 11.

Repoussé work is probably the highest branch of the silversmith's art, and calls for the most consummate skill. The name means "repulsed" or "pushed back" work, and is applied because the metal is raised by hammering on the object from within, that is, it is dented outward. As it would be manifestly impossible to insert a hammer in many small narrow-necked vessels, or to use it in any hollow object with any convenience, the snarling tool is employed. This is simply a metal bar having one end bent and secured in a vise and the other turned upward and tapered to a dull point. The design having been scratched lightly on the exterior of the object, the latter is slipped over the bar, so that the vertical end of the same comes just under the portions which it is desired to have in relief. The workman then taps lightly on the snarling iron, close to the vise. The resiliency of the bar causes the blows to be transferred to the silver; and at the same time it tends somewhat to equalize their force. As soon as the entire pattern is raised, the vessel is annealed because the hammering hardens the silver, and the subsequent operations depend entirely upon its ductility. If the ornamentation is to be in very high relief, the snarling is repeated, and the ornamentation raised still higher. Then another annealing follows, and so on, until the artist judges that the raised parts sufficiently protrude.

The vessel is now filled with a resin composition, which sets hard and gives a firm backing, and is then placed on a pad before the artist who does the chasing, Fig. 11. This chasing differs from the flat chasing previously noted, in being a very much more elaborate process. The artist has before him hundreds of minute steel punches, and with these he literally pushes the metal into the designs called for by the drawing. To make a raised flower, for example, he has first merely a bulge on the surface produced by the snarling tool. With his little punches, he pushes certain parts of the metal under the edges of the protrusion, throws up other portions, and finally the shapeless swelling is converted into the thin delicate flower petals, in full relief from the surface. Of course this is very costly and very lengthy work. We were shown a single tea set of four pieces—all quite small—which were covered with exquisite flowers and arabesques, and on which one man had worked for eighteen months. The price of the articles was \$1,500—a large sum to pay for the objects intrinsically considered, but not at all excessive when the work lavished on them is remembered. Ornaments for race cups and other decorations not attached to the surface are cast and afterwards carved.

There are three more processes for decorating silver, which we have yet briefly to review. Gilding is resorted to, not only for lining the interior of vessels but for producing tasteful designs on the exterior. The gold is deposited, by the electro-plating bath, upon such portions of the articles as may be desired, all of the surface of the latter save the pattern to be gilded being covered with wax. Enameling is an art by itself, and would form the subject of a paper even longer than the present general summary of the industry. It will suffice to say that the design is first engraved upon the object. Then the enamel, mixed with a little water into

a paste, is painted in the incised portions. The article is then fired in a special furnace; the enamel fuses, vitrifies, and, when complete, is nothing more than colored glass inlaid in silver. A very beautiful mode of ornamentation which was practised in the middle ages, but which has remained for centuries almost unused until revived by Messrs. Tiffany & Co., is niello work, or the inlaying of silver with different metals and compositions. A black enamel and red copper are used, the first being inserted in the incised portion of the work by the process above described, and the second, by electro-deposition. The effect of the rich color of the copper and the solid black of the enamel, in contrast with the pure white luster of the silver, is exceedingly fine.

In Fig. 12 is represented the famous Bryant vase, a magnificent specimen of *repoussé* silver work, made at a cost of \$10,000. The ornamentation is in high relief and chased with wonderful delicacy. This splendid work of art is in-



Fig. 12.—THE BRYANT VASE.

tended to symbolize Mr. Bryant's life and character through the medium of a classic form, covered with ornamentation drawn from Nature, and suggested by his works. The heavier lines of the fretwork are derived from the apple branch. Poetry is symbolized by the eglantine, and immortality by the amaranth, which is said never to lose its fragrance, and these are blended with the lines formed of the apple branch. The primrose, for early youth, and ivy, for age, form a border directly above the handles. Encircling the neck at the narrowest part, the immortal line "Truth crushed to earth shall rise again," is rendered *verbatim*, the beginning and end being separated by a representation of the fringed gentian, which Mr. Bryant remembers in one of his poems as always pointing to heaven. Eras in the poet's life are illustrated by a series of bas-reliefs. In the first, he is a child, looking up with veneration at a bust of Homer, to which his father points as a model. The second shows him in the woods, reclining in a meditative attitude. Between the first and second of these medallion pictures, is a portrait of the poet, laurel-crowned. Above this, the lyre for Mr. Bryant's verse, and beneath, the most primitive

printing press, in remembrance of his connection for over half a century with the New York Evening Post.

In a smaller medallion is the waterfowl, used by Mr. Bryant as an emblem of faith. The ornament around the lower part of the vase is of the Indian corn, with a single band of cotton leaves, and at the foot is the water lily. The designer has introduced these symbols from Nature, as the fittest means of illustrating the life of an author whose writings teem with symbols drawn from the same source.

It would be remiss on our part to close this article with merely a cordial acknowledgment of the courtesy with which every detail of the manufacture we have described was submitted to our inspection. The work which Messrs. Tiffany & Co. are now carrying on is of national importance; for their establishment is not only a great business concern but a school of art. In this country, where art museums and similar means of educating popular taste are few and far between, our people are in large measure dependent upon the art industries of Europe; and an immense amount of money is yearly expended in the importation of objects of ornament made abroad, which could be equally well manufactured here, did the requisite degree of cultivated artistic skill exist among us. This fact is now well recognized, and efforts are being made by public spirited men to provide the necessary collections whereon correct standards of taste are based; but Messrs. Tiffany & Co. are doing even more than this, for they are directly educating men as art workers. In the designing department of their factory, boys are admitted at an early age and taught to design; and already many superior workmen and artists have in this way been made.

A Tremendous Mining Blast.

On April 19, a mass of iron ore, reaching to a height of 170 feet from the base and perforated with three large arches, was blown to fragments. It was situated in the famous "21 Mine" of the Port Henry Iron Ore Company, Essex county, N. Y. The mine had been dug to a depth of 300 feet and a diameter of 600 feet, in the center of which stood the mass to be broken up, which contained nearly 80,000 tons of the finest iron ore. In the pillars which formed the arches, 100 holes were drilled horizontally, of 3 inches diameter, some of them being 40 feet deep. The holes were completely filled with vigorite, a new explosive; and the charges were fired by electricity, in two blasts. The first was completely successful, but it somewhat marred the effect of the second by breaking some of the electric wires; 40,000 tons of ore were thrown down, and will be removed before the remaining charges of the second blast will be fired.

New Facts about Iceland Spar.

Professor A. K. Eaton, of Brooklyn, widely known as the inventor of an improved spectroscope, describes in the *American Chemist* a curious fact about Iceland spar. Hitherto the statement has been currently made and accepted that the axis of the crystal is the only direction along which there is no display of the curious property of the spar—double refraction. Wishing to obtain the widest possible divergence of the two rays from the spar, Professor Eaton cut it in planes perpendicular to the axis of the crystal; and to his great surprise, instead of getting the utmost separation of the rays, he found no double refraction perceptible. Finally he cut a crystal in the form of a sphere, and, by experiments upon it, ascertained that the two images of the ray are superposed on each other, so as to make no double refraction, not only when the ray passes through the axis, but also when it passes through in a plane direction perpendicular to the axis. From Professor Eaton's diagram it appears that the greatest divergence is to be attained by passing the ray through at an angle of 45° to the axis of the crystal. The fact is decidedly important in the use of the polariscope.

Driving Horses by Electricity.

The French papers describe an invention for driving horses by electricity. The coachman is to have under his seat an electro-magnetic apparatus, which he works by a little handle. One wire is carried through the rein to the bit and carried to the crupper, so that a current once set up goes the entire length of the animal along the spine. A sudden shock will, we are gravely assured, stop the most violent runaway or the most obstinate jibber. The creature, however strong and vicious, is "transformed into a sort of inoffensive horse of wood, with the feet firmly nailed to the ground." Curiously enough, the opposite effect may be produced by a succession of small shocks. Under the influence of these the veriest screw can be endowed with a vigor and fire indescribable.

A Wonderful Spouting Well.

According to the *Miner*, the town of Wilcox, Pa., possesses a remarkable curiosity in the shape of a spouting gas well: It says: "There is an immense reservoir of gas in the hole, together with a seemingly endless supply of water, and there is evidently a gigantic and never-ceasing struggle between the two elements for the mastery. For a few moments the gas will throw the water to the height of one or two hundred feet, followed (by igniting the gas) by a volume of fire. Then the water will run back into the hole."

Communications.

Our Washington Correspondence.

To the Editor of the Scientific American:

The amount of cash receipts at the Patent Office would seem to indicate that business was reviving there as well as elsewhere—the money received on Friday of last week being over five thousand dollars, the largest amount, with one exception, ever realized in any one day since the establishment of the Office.

A few days since there was a report in the papers that Secretary Schurz would soon hear charges made against Commissioner Spear by J. McCleary Perkins, which was followed by this paragraph in the *Republican*:

"The statement that Secretary Schurz was to hear the evidence on certain charges made by one J. McCleary Perkins against Commissioner Spear, of the Patent Office, had no foundation in fact. There are several charges now pending against Perkins which may, when the Secretary finds time to examine them, result in barring Perkins from practicing before the Department, and which will doubtless be heard before any charges preferred by Perkins against any officer of the Government."

From this, it would appear that Mr. J. McCleary Perkins does not get along quite as well with the present Commissioner as he did for a time with the last one. Shortly after Mr. Duell took his seat, Mr. Perkins, having much more time on his hands than clients to occupy it, undertook to oversee the business of the Office. For a time, it seemed, from the authority he assumed, that he considered himself as Acting Commissioner, or at least Assistant Commissioner, and actually took possession of and occupied a desk in one of the rooms for his own private business, until Mr. Duell got tired of his officiousness, and he was refused its further use, since which time he has become what one of our papers calls him—"a chronic grumbler."

There has been a vacancy for some time past in the Board of Appeals, owing to the inability of Mr. Marble to take the position on it to which he had been appointed, as he was filling another office; and having now been appointed Assistant Attorney General, he has formally declined the position. It having been determined to fill the vacant office by a competitive examination, the Commissioner, Assistant Commissioner, and Assistant Attorney General were appointed as an examining board, before whom the following gentlemen who competed for the position were examined: Messrs. Fox, Wilkinson, Dyrenforth, Burke, Bartlett, Hedrick, Tilden, Durnall, Bates, Wilber, Catlin, Bowen, and Antisell, all of whom are members of the examining corps, except Dr. Antisell, who formerly served in that capacity, but resigned many years since. The examination is said to have been entirely practical, and to have reference to office work only. The board will examine the papers as soon as they can spare time from their current work, and report the three last to the Secretary, who will then nominate one to the President for appointment.

Application having been made by a printing firm in your city to register as a label a print representing a race course, without any descriptive matter thereon, the intention being to sell the print to customers to ornament their goods, the examiner rejected it on the ground that it should be registered as a trade mark, if registered at all; but the Assistant Commissioner on appeal decided that such a print does not meet the requirement of a trade mark or copyright, and that it should therefore be properly registered as a label, as it is not to be considered as a work of art, but is to be used for "other articles of manufacture."

Reports from nearly nine hundred counties in which winter wheat is raised have been received by the Agricultural Department, of which about one quarter are unfavorable; but in the remainder the yield promises to be from average to superior. Of three hundred and twenty counties in the Ohio basin, only forty-five report below the average. Grasshopper ravages are reported in twenty-two counties of Kansas, and the wheat-growing districts of Texas are said to be alive with these insects. There is, however, an increase of the area of wheat in the latter State, and the prospects are favorable in other respects. In the other cotton States, a dry autumn and variable winter have depressed the condition of wheat below the average.

The sixth report of the Government Inspector of the works for the improvement of the South Pass of the Mississippi is just received; from which it appears that, since November 18, 1876, about 16,000 cubic yards of material have been dredged at points where the channel was the worst. A part of the west jetty has been raised by mattresses and a layer of stone, until it is of a height of from six inches to two feet above the average flood tide; and one hundred and sixty-seven additional piles have been driven. A table accompanying the report shows that the depth between the jetties has gradually deepened from nine and two tenths feet in June, 1875, to twenty and a half feet in March of this year. At the head of the passes, the west T head has been extended up the stream, and its upper part made a solid dyke; a line of mattresses has been carried from the east T head down to the head of Goat Island; a solid mattress dam has been built across the old east entrance to the South Pass; and about 30,000 cubic yards of digging has been done. The rising of the river caused a sharp scour between the T heads, so that near twenty-four feet could be taken from the Mississippi into the South Pass on March 7, 1877.

The National Academy of Sciences is now holding its fifteenth annual session, at the Smithsonian Institute in this

city. The following papers have been read up to the time of writing this:

"On a new measuring instrument, the vernier microscope," by Professor A. M. Mayer. "On systematic errors in star declination," by Professor E. C. Pickering. "On the young stages of osseous fishes," by Professor Alexander Agassiz. "On critical periods in the history of the earth, and their relations to evolutions, and on the quaternary at such a period," by Professor Joseph LeConte, of San Francisco; read by Dr. John L. LeConte. "On the progressive motions of storms," by Professor Wm. Ferrel. "On the effect produced by mixing white with colored light," by Professor O. N. Rood. "On Newton's use of the term 'indigo,' with reference to a color of the spectrum," by Professor O. N. Rood. "Improved method of obtaining metallic spectra," by Professor G. F. Barker. "On the internal structure of the earth as affecting the phenomena of precision and mutation," by General J. G. Barnard, U. S. A. "On a proposed new method of solar spectrum analysis," by Professor S. P. Langley, director of the Alleghany Observatory. "On complex inorganic acids," by Professor Wolcott Gibbs. "On a micrometer level and topographical camera," by Professor E. C. Pickering. "On the determination of the co-efficient of expansion of solids," by Professor A. M. Mayer. "On the results of deep sea dredgings," by Professor A. Agassiz. "On a new detached gravity escapement, invented by Professor Young," by Professor Barnard. "On the laws ruling the vibrations of tuning forks," by Professor A. M. Mayer.

Many of these papers and the discussions that followed were deeply interesting; and as the session will continue a day or two more, it is probable that other equally interesting subjects will be discussed. The following gentlemen were elected members: Dr. John W. Draper, of New York; Dr. Scudder, of Cambridge; Dr. Elliott Cones, Dr. Henry Draper, of New York; and Mr. C. S. Pierce, of the Coast Survey.

The War Department will, it is said, at the coming extra session of Congress, call for an appropriation for the manufacture of improved arms, so that their accumulation might place the government in readiness for any emergency. It is stated that there will not be more than about 8,000 arms of the improved patterns on hand at the close of the present year; and that if the States should draw all they are entitled to, the stock of improved arms held in reserve would be exhausted. The style of gun now being manufactured is that known as the Springfield breech-loading rifle, and it is argued that these guns should be manufactured in sufficient quantities to render a gradual accumulation of them in store a certainty, as otherwise the government may find itself without arms at a time when they may be wanted very badly. The ordnance officers are also complaining about the meagre means of defense on our coasts and harbors, asserting that we have little or no means of operating against the heavily armored ships that the European powers could bring against us, excepting the torpedo boats, which are as yet but in the experimental state. It is stated that several experimental guns have been made; but they cannot be tested, as no money has been appropriated by Congress for that purpose.

In consequence of a recent decision of the Supreme Court respecting the eight hour law, Secretary Sherman is about to issue an order that hereafter no officer shall pay ten hours' wages for eight hours' work, thus practically reversing the order of General Grant constituting eight hours a day's work.

One of our street railroads has received permission to try the dummy engines now successfully used in Philadelphia, and will shortly introduce them on both their lines, if on trial they meet with approval.

Washington, D. C.

OCCASIONAL.

Letter from the Oldest Locomotive Engineer now Living.

To the Editor of the Scientific American:

I am probably the oldest living locomotive engineer in the United States, possibly in the world. In the year 1832, I think, the Schenectady and Saratoga railroad went into operation, and in that year imported a locomotive engine from England, made by George Stephenson, and named after him; an engineer named Turner came with it and ran it for some months; but as he was a man in poor health, I frequently was called upon to fill his place, as I was then superintendent of Clute & Bailey's machine shop and foundry, where the work for that road was generally done. The engine above mentioned, I think, was the first in the United States placed and run upon any railroad. The Mohawk and Hudson was the first railroad built in the State, but was operated by horse power for several years, with stationary engines at both ends for hauling up and letting down the passenger cars on the inclined planes at Albany and Schenectady. I saw a short article in some paper a few years since, saying that the locomotive engine above mentioned was still in the city of Schenectady, laid up as a curiosity in some establishment there, for I assure you it was a curiosity, when compared with those of the present day.

I have never followed the occupation of an engineer either on a steamer or locomotive regularly, having always preferred that of a machinist, so as to be at home with my family at night, although in my younger days I have frequently operated on both when necessity required it. I am now 77 years old, and for the last 35 years have been living on my farm in the mountains of Georgia, enjoying good health; I

am hearty and active, and can do as good work as I ever did, and can mount a horse as spry as when 45 years old. I presume you have had a description or descriptions of the locomotive alluded to, or I would send it, as well as my recollection serves me.

Clarksville, Ga.

J. VAN BUREN.

Remarkable Explosions.

To the Editor of the Scientific American:

In the year 1873, some parties in this city conceived the idea of pulverizing brimstone, which was done successfully. The product very closely resembles flowers of sulphur, and many tons of it have been sold, the greater part to sheep farmers. At the time of the first attempt, we had pulverized about a hundred tons, and were just about stopping the machinery when a terrible explosion took place; and in a few minutes the mill building was all in flames and completely destroyed. The mill at the time was full of fine dust of sulphur, especially the upper story, where it was floating thick in the air. The explosion seemed to be mainly in the upper story. There was no fire in the building, nor was there any person smoking, and the affair seemed a mystery to everybody. Many who pretended to be chemists and experts said there was nothing to be feared from grinding sulphur; but I maintained that either sulphuretted hydrogen was generated in some way by the attrition, or that the impalpable dust, mixed with the air, was the cause of the explosion. I told the mill owner that it would explode again if the attempt was repeated; but he did not mind me, and when he rebuilt the mill he tried it again. When we were just about stopping after finishing a lot of seventy tons, on July 25, 1874, another terrible explosion took place, with the same circumstances attending it as on the previous occasion. The mill was burnt to the ground. Since then the owner of the mill never tried sulphur grinding again.

San Francisco, Cal.

J. W. MORRISSEY.

Pneumatic Transmission of Time.

To the Editor of the Scientific American:

In your issue of April 21, 1877, is an article on the transmission of correct time in Vienna, Austria. Allow me to state that the transmission of time by a pneumatic system has been in use in San Francisco since February, 1874, where, in the London and San Francisco Bank Building, one regulator transmits the time to 14 dials. This invention (of Mr. H. Wenzel, of San Francisco) was patented in July, 1873, and is so satisfactory that it has been also introduced in the Nevada Bank Building, with 26 dials; in the San Francisco Club House, with 8 dials; in Baldwin's Hotel, with 62 dials, and into a number of private houses. One of these clocks, with a most ingenious, original improvement on the escapement, termed "force constant," and connected with several dials, to which any number of dials in the same or adjacent buildings may be added, is now in operation, and can be seen at Mr. C. W. Schumann's office, 24 John St., this city.

New York city.

L. BECKERS.

Stream Power and its Utilization.

To the Editor of the Scientific American:

An article appeared in the SCIENTIFIC AMERICAN of April 28, 1877, under the above heading, for which you credit the *Millstone*. I know not to what the *Millstone* gave credit for the article; but I am sure that it ought to have given credit for the article to the SCIENTIFIC AMERICAN of January 14, 1871. If you will refer to that number of your journal, I think that you will acknowledge that no one can be more positive as to the origin of that article than your humble servant. It is one of the weaknesses of humanity to be pleased with due thanks for one's fugitive ideas and compositions.

Worcester, Mass.

F. G. WOODWARD.

American Inventive Progress.

"Under the above heading the SCIENTIFIC AMERICAN of May 7th has a long and interesting article, from which we make the following extracts:

"To show with what rapidity inventors made improvements on inventions embodying original principles," says the writer, "it may be noted that, in the early days of the sewing machine, 116 patents were granted for improvements thereon in a single year; and out of the 2,910 patents issued in the year 1857, 152 were for improved cotton gins and presses, 164 for improvements on the steam engine, and 198 for novel devices relating to railroads and improvements in the rolling stock. In the year 1848, three years after the publication of this paper was commenced, but 660 patents were granted; but under the stimulus of publishing these inventions as they were patented, ten years later, in 1858, the number had increased sixfold, reaching 3,710, while up to January 1, 1850, as already stated, the aggregate of patents issued amounted to 17,467; since that time and up to the present period the total is 181,015.

"And curiosity here leads us (adds the editor) to review our own work, extending back, say, twenty years, or to 1857, a period during which 170,745 patents have been issued. We find, by actual count, that 63,062 applications have been made through the Scientific American Patent Agency for patents in the United States and abroad. This averages almost ten applications per day, Sundays excluded, over the entire period, and bears the relation of more than one quarter to the total number of patents issued in this country up to the time of writing."—*Philadelphia Evening Bulletin*.

PRACTICAL MECHANISM.

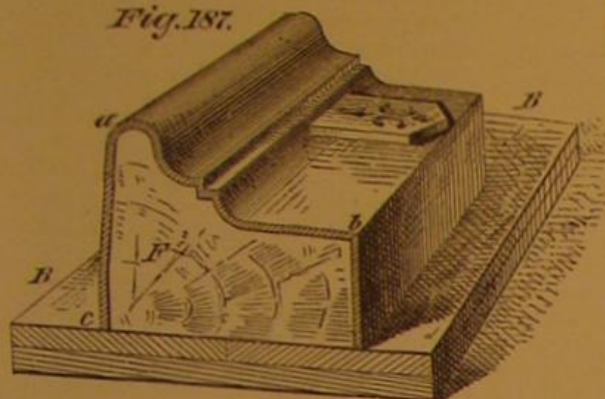
BY JOSHUA ROSE.

NEW SERIES—No. XXV.

PATTERN MAKING.—THIN WORK.

In the examples we have hitherto presented to the reader, we have supposed the pattern to be of such substance or thickness as to be able to bear the pressure of the sand being rammed about it in moulding without breaking or altering its form; but this is not always the case. The parts of a stove, for instance, are cast often less than $\frac{1}{4}$ inch in thickness; the same may be said of most of the ornamental iron-work used in architecture, and even cornices and window sills range only about $\frac{1}{8}$ or a $\frac{1}{4}$ inch thick. It is true that for this kind of work metal patterns are almost invariably used; but for the pattern maker this is indifferent, as wood patterns have to be made from which the metal patterns are to be cast. Take, for example, the window sill shown in section in Fig. 187; to enable it to withstand the pressure of the sand while ramming, we must fill the interior with a

Fig. 187.



form or block, shown at F, which is to be used in conjunction with the board, B. This form and board are no less useful to the pattern maker than to the moulder; for let the form be once obtained of the proper size and shape, and the construction of the pattern is so far simplified as to be merely a covering of this form with wood slightly thinner than the required thickness of metal. Most thin work is made in this manner, especially if the patterns are of such size or shape as to need the joining together of many pieces; it is not the pattern itself that demands our first attention, but rather the form that supports it.

Thin work demands great care and patience on account of its fragile nature. Scarcely any hold can be obtained for nails; and though the best glue is used, it cannot always be relied upon. Dovetails for square corners, if they are end wood to end wood, will be found very superior to glued joints. Furthermore, as few joints should be made as possible, and the pattern should be well protected by several coats of varnish. In working out thin mouldings, as for instance, the portion of the sill from a to b, which should be of one piece, we plane up a piece of a suitable width and thickness, and trace the outline of the moulding upon each end of the piece; then, as it lies flat upon the bench, we work out on one side to the lines which will fit the form, as in Fig. 188, and then, by temporarily fastening the piece to the

Fig. 188.



form, F, to give it proper support, we are enabled to work out the opposite side to the required shape. In working out thin mouldings, a circular saw with an adjustable table will be of great assistance, as by its means we may make a series of saw cuts so close together as practically to take out half the stuff, and form an excellent guide for cutting away the other half (see Fig. 188). The part from a to c, Fig. 187, should not be formed by gluing thin stuff together at the obtuse angle, but should be of one piece. Fig. 189 is a section of a cornice lying upon its bed or follower board, B; it may be made of one piece, as in the previous example.

Fig. 189.



In moulding work of this kind, the procedure is as follows: The board, B, with the form and pattern, is placed upon a level bed of sand so that it may not wind or twist under the weight that is to be put upon it, which will consist of the nowel rammed full of sand. The board and nowel are fastened together by cramps, and, the ramming finished, the whole is turned over; the board and form are then removed. There is no longer any necessity for the support of the latter, as the sand, having been once rammed, does not press upon the pattern to its injury, but keeps its position and becomes a good and sufficient support to it during the ramming up of the cope, which is now placed in position, and the moulding continued in the usual manner. Instead of the form, F, which fills the interior of the pattern, we may provide a

strong enveloping form, as shown in Fig. 190; the difference is that the reverse side of the casting will be uppermost as compared with the other case. The form must fit that side of the pattern which we wish to come next the cope. Forms of an irregular or difficult shape are often advantageously made by simply pouring plaster of Paris into the patterns for which they are intended. A great deal of thin work is formed by dry sand coring, often from necessity; but when practicable, the dry sand core is discarded and the pattern made to leave its own core. This insures greater accuracy,

Fig. 190.



is cheaper, and causes the interior surface of the casting to be the same as the exterior. When dry sand cores are employed, there is no difference between thin work and thick, and therefore the methods described in former pages are a sufficient explanation of the process.

Duties of an Engineer in the Care and Management of a Steam Boiler.

The following instructions may be of little importance to skilled engineers, as such are supposed to be thoroughly versed in all the matters discussed; but to young and less experienced engineers, we believe that the directions, from the *Indianapolis Mechanical Journal*, will be found useful.

The first duty of an engineer when he takes charge of an engine and boiler is to examine his boiler and see that the water is at the proper level. The water should be kept up to the second gauge whilst working, and up to the third at night. The reason why the water should be raised at night is to prevent it from becoming too low from leakage or evaporation. In case the water should become dangerously low, the engineer should immediately draw the fire and allow the boiler to cool, and not admit any cold water to the boiler or attempt to raise the safety valve, as it would be positively dangerous. The reason why it would be dangerous is, that it would lessen the pressure in allowing the steam to escape from the boiler, thus allowing the water to rise up and come in contact with the overheated iron, and probably cause an explosion. In case the water supply should be cut off from the boiler for a short time, he should cover his fire with fresh fuel, stop his engine, and keep the regular quantity of water in the boiler until the accident is repaired and the water supply renewed. To get up steam, the engineer should first see that the water is at the proper level; he should then remove all ashes and cinders from the furnace, and cover the grate with a thin layer of coal; and after placing his wood and shavings on the coal he will be ready to start his fire. The advantage in placing a covering of coal on the grate before the wood or shavings is that it is a saving of fuel, as the heat that would be transmitted to the bars is absorbed by the coal, and the bars are also protected from the extreme heat of the fresh fire. An engineer should allow his fire to burn gradually when commencing to get up steam from cold water, as by allowing the fuel to burn very rapidly some parts of the boiler become expanded to their utmost limits, while other parts are nearly cold. Of course, a great deal depends upon the time in which he has to raise his steam. An engineer should regulate his fire at a uniform thickness, and not allow any bare places or accumulations of ashes or dead coals in the corners of the furnace, as these places admit great quantities of cold air into the furnace, and render the combustion very imperfect. An engineer should avoid excessive firing as much as possible, as it is attended with more or less danger, because the intense heat repels the water from the surface of the iron and allows the boiler to be burned. He should keep about three inches of anthracite coal and about five inches of soft coal on his fires, but he should regulate the thickness of the fire according to the capacity of the boiler. If the boiler is too small for the engine the fire should be kept thin, the coal supplied in small quantities and distributed evenly over the grate, and the grate kept as free as possible from ashes and cinders; but if the boiler is extra large for the engine, the thickness of the fire makes but little difference. If the fire becomes very low, he should neither poke nor disturb it, as that would have a tendency to put it entirely out; but he should place shavings, sawdust, wood or greasy waste on the bare places, with a thin covering of coal; then, by opening the draught to its full extent, the fire will soon come up. If it should become necessary to burn wood on a coal fire, it is always best to make an opening through the coal to the grate bars, so that the air from the bottom of the furnace can act directly on the wood and increase the combustion. He should give great attention to the regulation of the draught in the furnace, as it is one of the most important parts of an engineer's duties, for in fact it is next in importance to the regulation of the water in the boiler.

It is well known that immense quantities of fuel are recklessly wasted by ignorance and carelessness in the management of the draught. He should not have any more draught at any time than would produce a sufficient combustion of the fuel to keep the steam at the working pressure, as by opening the damper to its utmost limits great quantities of heat are carried into the chimney and lost. An engineer cannot carry out this plan in all cases—only in furnaces

and boilers that are sufficiently large to furnish the necessary amount of steam without forcing.

Of course, where the boiler is too small for the engine, or has not sufficient heating surface, it is impossible to economize fuel. In some cases it is a good plan to throw a jet of steam under the furnace bars when the draught is insufficient to produce the necessary combustion of the fuel. It is considered an advantage, before clearing a fire, to throw some water under the grate bars, as the oxygen of the steam thus generated under the furnace will unite with the oxygen of the atmosphere, and insure a more rapid combustion of the fuel after the fire is cleaned.

Steam or water should not be thrown under the grate bars of locomotive boilers when such boilers are used for stationary engines, as steam or water in the ash-pit forms a lye with the ashes, and corrodes the iron and destroys the water legs of the boiler. An engineer should always keep his pit clean, as by allowing the ash pit to become filled with ashes and cinders the air becomes heated to a high temperature before entering the fire, which naturally interferes with the combustion of the fuel. The grate bars also become overheated, and in many cases badly warped or melted down. He should at all times watch his safety valve carefully, and keep it in good working order. He should do this at least once a day; the morning is the proper time, and then he will feel safe during the day. We have often seen safety valves with all kinds of weights on them, and it at once gave us a poor opinion of the engineer. No first-class engineer will do this. It should be one of the main reasons for discharging him. In blowing out a boiler, remove all fire from the furnace, and see that the steam is at the proper pressure—say from 45 to 50 lbs. Always close the damper.

At least one hour should pass between drawing the fire and blowing out the boiler. This will allow the furnace to cool and prevent the boiler from being injured with the heat after the water is all blown out. The higher the steam pressure, the higher the temperature of the iron, so that by blowing out the boiler under a high steam pressure the change is so sudden that it has a tendency to contract and cause the boiler to leak. The boiler should not be filled with cold water immediately after blowing out, as the introduction of cold water into the boiler before the temperature of the iron becomes lower would, in all probability, cause the boiler to leak. The boiler should be blown out whenever any appearance of mud is found in the water. When fresh water is boiled, it is supposed to deposit its mineral, and after that it is not advisable to blow out the pure water and fill the boiler with water holding matter in solution and suspension; and for this reason once in two or three weeks is often enough to blow out the boiler. When filling the boiler, some cock or valve in the steam room should be opened and allow the air to escape. If not, the air would retard the ingress of the water, and also collect in the steam-room of the boiler, and prevent the regular expansion of iron when the fire is started.

The steam-room in a boiler is that portion of the boiler occupied by steam above the water. The water room is that portion of the boiler occupied by water. The fire line of the boiler is a longitudinal line above which the fire cannot rise, on account of the masonry by which the boiler is surrounded. The tubes of a boiler should be cleaned at least once a week; all ashes and soot should also be removed from the outside of the boiler. This all makes a great saving in fuel, as it allows the fire to act directly on the iron. Boilers should be cleaned at least once in three months. All stays, braces, seams, and angles of the boiler should be examined carefully. He should also sound the shell of the boiler with a very light steel hammer. It is a good way to determine the condition of the iron.

The steam gauge should be tested at least once a year. It should be done by a test-gauge, made expressly for the purpose. The water gauge should be kept clean, inside and out, and all points belonging to same. By opening the drip cock and closing the water valve and allowing the steam to rush down the glass, the steam will carry out the mud and sediment. They should also be swabbed out with a piece of cloth or waste on a small stick when the boiler is cold; but care should be taken not to touch the inside of the glass with wire or iron, as an abrasion will immediately take place.

Decay of Timber.

Wet and dry rots are the two forms of decay which attack timber that is exposed to the action of the weather, and the cause of both may be said to be heat with moisture. Confined air and evaporation cause dry rot, and imperfect evaporation wet rot to a greater or less degree.

Investigation shows that as a preventive against these rots the timber should be well seasoned, and if used where liable to be under the influence of sun and rain should be well painted, or, if not painted, should be impregnated with linseed oil or oil of tar. The best preventive, however, is found to be that of allowing a free circulation of air around the timbers, and the walls to be allowed to dry thoroughly before the introduction of the timbers; should the timbers have taken either of these rots very little can be done to preserve them. In case the rot is perceived to be at the end of beams only—where in fact it generally commences—the best method of preserving the rest of the timbers is to effectually cut away the decayed portion and scarf with sound; if, however, this should not be practicable, the wood may be scraped and cleaned of all fungus or extraneous matter and then impregnated with any of the usual oils.—*Cincinnati Trade List*.

IMPROVED FIRE ESCAPE.

We noted last week the necessity existing for some simple and efficient fire escape, which could be rolled in small compass so as to be conveniently stowed in the traveler's satchel or trunk. The invention illustrated in the annexed engravings aims to supply this need. It consists of about a hundred feet or less of wire rope, one end of which is turned up to form a loop which is secured by wire seizings. In this loop, which is lined with leather to prevent chafing, a spring hook is secured. Along the rope, crossbars or rests are lashed with wire, at intervals of about 15 inches. These bars are of iron, having a portion of their surface flattened near the centers on one or both sides, and are inserted through the strands of the rope (Fig. 2).

The apparatus can be very quickly got ready for use, as it is only requisite to screw an eye into the woodwork or flooring of the room, attach the snap hook, and lower the escape out of the window, whence it forms a ladder, Fig. 1. The inventor also provides a strap, Fig. 3, which carries a staple to which, after the strap is passed around a trunk, the end of the fire escape rope is attached. The trunk is thus easily lowered; and after reaching the ground, it serves as a means of steadying the ladder. By the same means, women, children, or invalids may be lowered from windows.

Patented through the Scientific American Patent Agency, October 24, 1876. For further particulars, address the inventor, Mr. H. R. Houghton, West 42d street, New York city.

Age of Labor-Saving Appliances.

The *Manufacturing and Trade Review* thinks that the greatest reason why there is such an over-proportionate abundance of all kinds of products as compared with former times, and comparatively so few workmen are employed, is that these products are the results of mechanical appliances, one of which does the labor of numbers of workmen. Instead of hoes and spades, and sickles, and scythes, and flails, the cultivators, planters, reapers, and mowers, and thrashers are used. So with the production of the nail, horseshoe, cutlery, tools, clothing; in fact, what is not made by machines for the purpose is very far behind the age. The business of the world now is inventing, improving, and running machinery and appliances to make machinery and tools, and in producing the articles they make; and the aim of the present workman must be to thoroughly know the use and care of machinery, the strength and adaptability of materials for the manufacture of appliances. If the world seems to be already supplied with all these, then his business is to possess the machine or appliance and use it in producing the thing which his taste and judgment may suggest. It is useless to resist this march of machinery. Only the man who accepts, adopts, and enters most heartily into its use and product, will keep abreast of the present progress.

IMPROVED CALCULATING MACHINE.

The drudgery of mental computation, of all labor, is perhaps the most enervating and uninteresting; and an effectual device to remove or even lessen the mental effort will be readily appreciated by mathematicians, engineers, bankers, actuaries, and accountants.

The calculating machine, properly so called, must not be confounded with the simple slide rules, adding machines of various kinds, interest tables, and other devices called by the same name. This instrument is a piece of mechanism that performs its task in a direct and complete manner, taking in a great range of work, and using and giving numbers at full length and in plain figures.

The construction and operation of the apparatus as illustrated herewith are both simple. There is an upper cylinder, which is turned by the crank, and which itself drives a smaller shaft underneath. A slide, that can be set in eight different positions on the cylinder, carries eight figured rings that can be set to represent any number of eight or less decimal places. Each turn of the crank adds the number set up on the rings to the number represented on the ten recording wheels carried by the lower shaft. The multiplication process will best be understood by an example. To multiply 347 by 492, the three upper rings are set at 3, 4, and 7, respectively. The cylinder is then turned twice to multiply by the units figure of the multiplier. If now the slide is carried along one notch, where each ring will act on the next higher recording wheel, and turned 9 times, 347 will be multiplied by 90, and the product at the same time will be added to the product already scored. Another shift of the slide and four turns will complete the operation, and show the result, 170724 = (347 × 2) + (347 × 90) + (347 × 400).

upon the recording wheels. A half turn of the crank backwards erases this result, bringing all the wheels to 0, ready for the next operation.

Division is the reverse of multiplication. The dividend is set up on the wheels, the divisor on the rings, and the quotient records itself on the upper recording wheels. The machine of the size illustrated will use numbers of eight or less figures, and show the result in full, if not over ten figures, and its upper figures if more than ten places are necessary. The dimensions of the instrument are 13×5×7 inches, and

claimed to have an advantage of three to one over common logarithms; and it is quicker and easier to use natural numbers and natural sizes, tangents, etc., on the machine than to use the common logarithmic method.

The patentee and manufacturer is George B. Grant, 84 Beverly street, Boston, Mass. He will supply any further information.

New Theory of the Origin of Petroleum.

The origin of the immense quantities of hydrocarbon oils which are found saturating strata of sandstones, or pent up in cavities of the older rocks, or escaping to the surface and collecting upon pools of water, has been the subject of frequent discussion. The theory generally accepted, and endorsed by such names as Hunt, Newberry, and Silliman, is that it is of organic origin, either vegetable or mineral. It has even been suggested that the bad smelling petroleum of Canada owes its origin to decayed fish. According to T. Sterry Hunt (*American Journal of Science*, March, 1863), "the pyroschists of Bosanquet belong to the Devonian series, and contain the remains of land plants, so that a partially decayed vegetation may be supposed to have been the source of the organic matter which is intimately mingled with the earthy base of the rocks; * * * but in the pyroschists of the Utica formation, the chief organic remains to be detected are graptolites, with a few brachiopods and crustaceans."

In view of these facts we are not a little surprised at the new and yet plausible theory advanced by the distinguished Russian chemist, Mendeleeff, before a meeting of the Chemical Society of St. Petersburg. The appearance of oil on the surface of the earth proves that it has a tendency to rise through the various strata of the earth, and this is no doubt due to its being lighter than water, which, being everywhere present, forces it upward. For this reason we are compelled to suppose that it was formed lower down in the earth than the places where it is now found. Another reason for this belief is that the sandstones, in which much of this mineral oil is found, contain no charred organized remains, which must be present where the oil was produced, if it be of organic origin. Since petroleum is found in the Caucasus in tertiary, and in Pennsylvania in the Devonian and Silurian, its origin must have been in the older rocks at a still greater depth. But in those ancient periods, like the Silurian, not many organized beings could have existed. Hence Mendeleeff thinks that it is very improbable that petroleum is the product of any decomposed organic matter.

Mendeleeff starts with Laplace's theory of the formation of the earth, applies Dalton's law to the original gaseous condition of the constituents of the earth, and calculates the probable arrangement of the metals in the earth from the density of the globe and the vapor density of the elements. Starting with the assumption, which is not improbable, that iron is the most abundant of metals, since it is present in large quantities in the sun and in meteorites, and admitting the existence of carbon compounds of this metal, not only will it be easy to explain the formation of petroleum, but one can understand all the peculiarities of its occurrence in those places where the earth's strata has been broken by the elevation of mountain chains. Breaks made in this way permitted the water to permeate to the carbonaceous metals; and at the high temperature, and under heavy pressure, it acted upon them, forming oxides of the metals and saturated hydrocarbons. The latter rose as vapors to the higher strata, where they were condensed, saturating the porous sandstones, which are capable of absorbing many oily products.

Many other phenomena of nature are explained by this theory of the formation of petroleum, such as predominance on the earth's surface of elements with small atomic weights, the occurrence of oil in straight lines or arcs of huge circles, its dependence upon volcanic action, which has been noticed by Abich and others, the magnetism of the earth, and many other natural phenomena.

Salicylic Acid.

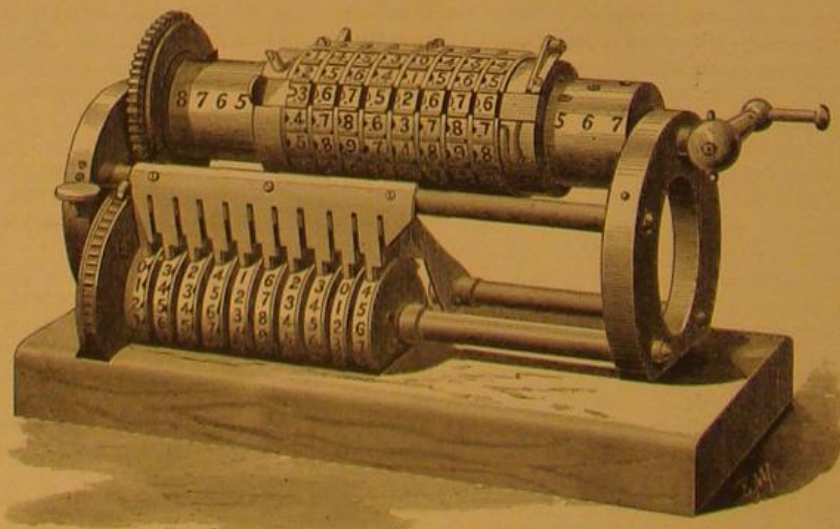
M. Blandeau, of Paris, states that, according to dentists, this agent has injurious effects on the teeth. English observers have noticed its effect on the bones, and necrosis of the tibia has been assigned to its use. It evidently possesses considerable affinity for the calcareous salts of bone, and we see the urine loaded with lime salts in an ultra-physiological proportion, from the internal use of the acid. The salicylate of soda presents the same dangers; and too much caution cannot be taken in the use of any salicylic preparation.



HOUGHTON'S FIRE ESCAPE.

it contains but eighty working pieces of mechanism, none of them small or delicate. Made mostly of brass and iron, its smaller parts are of steel, portions of which are tempered. Its results are shown in plain figures, stamped on unpolished silver-plated surfaces and filled in black. All prominent parts are nickel-plated and polished.

The machine was invented in 1870, but was not manufactured for general use until this year. It was introduced to the public for the first time at the Centennial Exhibition; and the official report, signed by such well known men as President Barnard, of Columbia College, Professor Hilgard,



NEW CALCULATING MACHINE.

of the United States Coast Survey, Professor Joseph Henry, Professor J. C. Watson, and Sir William Thomson, says: "It is simple in construction, not liable to get out of order, its use greatly saves the mental labor of computation, and lessens the liability to error. It is deemed superior to all other instruments of its class yet produced." Other well known experts state that a saving in time of more than sixty per cent is effected over ordinary methods.

Upon work of four or five decimal places, the machine is

BABY BRUTES.

The Central Park menagerie, or rather Mr. P. T. Barnum, who is the proprietor of most of the animals exhibited free to the public during the winter, has recently become possessed of a litter of panthers, two lions, a baboon, and a dromedary, all born in the cages. Of the baby lions and panthers, engravings are given herewith. The lions are now nearly four months old, and are about as tall as a moderate-sized terrier dog. They are exceedingly fat, and, like all young of their species, are covered with a short downy fur, profusely mottled. They possess, in brief, all the characteristics of kittens, except gracefulness of motion; for they are the personification of clumsiness. Their legs are thick, short, and bent, their paws, which already possess formidable claws, appear too large, and their bodies are long and ungainly. The temper of the infants, despite their innocent and childlike expression, is none of the best; for they show ranges of white sharp teeth, and spit viciously on any stranger approaching their cage. The cubs are of especial interest to zoologists from the fact of their being the offspring of a cross between the Asiatic and African species of lions. This mingling of breed has not before been attempted, and the characteristics of the young will be carefully watched.

The panthers are of the ordinary variety, peculiar to this country. As is the case with most untamable brutes, they breed unfrequently in captivity. The cubs are of the same age as the young lions; and were it not for their peculiar markings, resembling closely those of some species of young deer, they might well be mistaken for good-sized cats. Their behavior, when stirred up, is a ludicrous mixture of fear, curiosity, and defiance. A slight poke from the end of a cane causes the cub touched to beat a speedy retreat toward the mother; then it turns and watches the stick with intense interest, relieving its feelings by an occasional spit. Finally one paw flies forward, and a spiteful dig is administered, and then another retreat takes place. This is continued as long as the intruding object remains in the cage.

It is curious to notice, both in the lioness and in the panther, that peculiar pride in showing their offspring which the domestic cat manifests in the most unmistakable manner. It seemed also as if the old animals regarded raps on the bars of the cage, or the introduction of canes to induce their progeny to take better attitudes for sketching purposes, in the light of grateful attentions; as, no matter how much the young ones spit and scratched, the mothers never showed the slightest resentment, but quietly crouched and stared at the interloper in abstracted calmness. The writer saw the lioness deliberately wake up her cubs, who were cuddled into an undistinguishable ball of fur, and spread them apart with a blow of her paw, for no reason that could be divined other than that she wished to display them. They manifested no hunger, but sat up, as they are shown in our engraving, and blinked like suddenly awakened babies, until their eyes became accustomed to the light.

Plating of Iron and Steel with Nickel and Cobalt by Immersion.

Mr. F. Stolba—in a German periodical which we should be glad to give credit to, if there were not six words and fifty-seven letters (including forty-two consonants) in its name—proposes the following simple process for nickel-plating polished iron and steel articles. To a dilute solution (5 to 10 per cent) of as pure chloride of zinc as possible, there is added enough sulphate of nickel to color it strongly green. This is heated to ebullition in a porcelain vessel. The objects, being completely cleaned of grease, are then suspended in the liquid so that they touch each other as little as may be; and the boiling is kept up for from half an hour to an hour, water being from time to time added in place of that evaporated. The nickel is precipitated in a brilliant white layer wherever the surface of the object is not greasy or rusty. The operation can be continued for several hours if desired; but the plating will not thus be rendered much thicker.

After removing the objects, they are washed with water holding chalk in suspension, and carefully dried. They may afterward be cleaned with chalk, and they take a fine yellowish-toned polish. The chloride of zinc used should contain no metal precipitable by iron. When it cannot be obtained of sufficient purity, it may be made by dissolving zinc scraps in hydrochloric acid, and allowing the solution, containing an excess of metallic zinc, to rest, in order that the metals precipitable by the zinc may separate. Filter at the end of 24 hours, and the solution is ready for use; each portion of zinc dissolved corresponds to about 2.1 parts of chloride of zinc.

The sulphate of nickel should also be as pure as possible, and the cold solution should not precipitate when a plate of iron is plunged in it, as would happen, for example, if it contained copper. When during the operation the liquor becomes a pale green, owing to the precipitation of nickel, more sulphate must be added until the intense green is regained. When the used liquid is exposed to the action of the air, it deposits hydrated oxide of iron, coming from the dissolved metal. It should be filtered, and more chloride of zinc and sulphate added, when it may be again used.

In the same way, polished iron and steel objects may be covered with a brilliant plating of cobalt, by using a sulphate of cobalt solution. The appearance of this plating differs little from that of polished steel. The distinguishing characteristic is the light rose-colored tint. The author states that the plating wears well.

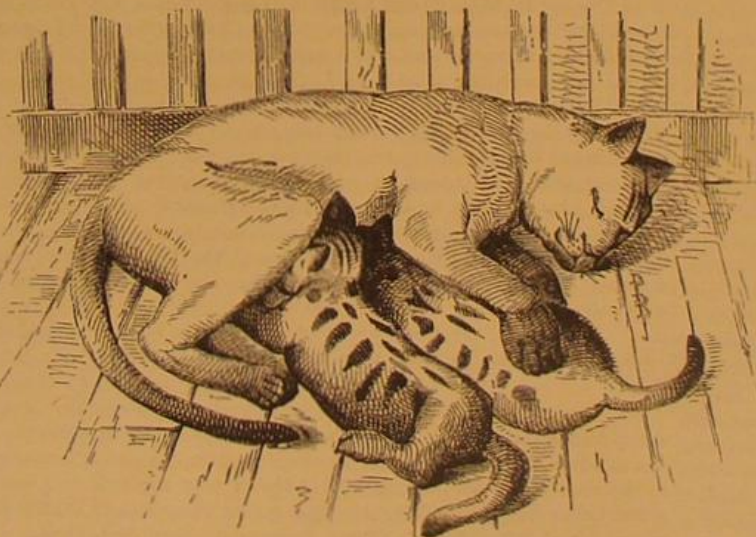
A New Class of Blowpipe Reagents.

Of all methods of analysis, that performed in the dry way by means of the blowpipe deserves the palm on the score of simplicity. The reagents are only four or five in number, the apparatus so small and portable that it can be carried in the breast pocket; and yet in most cases, with a little skill, the results are quite as satisfactory as those obtained in a completely equipped laboratory. There are, however, some cases, unfortunately but few, where the blowpipe reactions are not as simple as might be desired: such are those



YOUNG LIONS IN CENTRAL PARK, NEW YORK.

with boron and the iodides; but Messrs. Ihles and Devereux recently have overcome these. One necessity of every blowpipe set has always been a bottle of strong mineral acid for decomposing carbonates, detecting limestones, etc. On a journey, as at all times, acids are unsafe companions in pocket or portmanteau. A recent discovery of Dr. H. Carrington Bolton helps us over this quicksand, and enables the analyst to dispense with liquids entirely. The new departure (which is original, we believe, with Dr. Bolton) consists in the use of dry crystalline organic acids, such as tartaric, citric, and oxalic. When required for use, a few crystals are thrown into water; the mineral to be tested, which must be in a very fine powder, is introduced; and then, with or with-



PANTHER AND HER YOUNG, CENTRAL PARK, NEW YORK.

out heat, as the case may be, solution is accomplished. The facility with which the mineral dissolves in one or the other acids aids to determine its name. Even sulphides and silicates may, in several cases, be brought into solution by organic acids; and when the acid alone fails, it can be mixed with saltpeter (potassic nitrate) and the mineral thus decomposed.

A new field of very wide extent and unlimited interest opens here, and we hope Dr. Bolton will explore it to its furthest boundaries. Perhaps a new kind of analysis will be developed, to which we would give the term organo-wetish-dry testing.

SOMEBODY has perpetrated the following on Captain Eads' work on the Mississippi: "Those willow mattresses at the mouth of the Mississippi make the bed of the river more comfortable, to be sure. But still the shipping don't lie there nearly as long as formerly. If they are bound to New Orleans, they 'get up' as soon as possible."

ZINC, it is said, may be purified by precipitating its sulphate with an alkali, mixing the oxide thus produced with powdered charcoal, and exposing the mixture to a red heat in a covered crucible.

Dangers from the Dead.

That the dead should kill the living seems a paradox; yet nothing is more true. Indeed, we venture to say that every year, in our land, corpses murder more people than assassins do. Not only have intramural interments poisoned whole blocks and quarters, not only has drinking water contaminated by graveyards yearly spread disease and death through country hamlets, but, before the process of decomposition commences, there is often a great and pressing danger from infectious disease. We quote a recent instance:

"Dr. Goldie, the Medical Officer of Health for Leeds, England, in his report to the local authority, states that every one of thirty people who attended the wake of an Irish girl, who recently died in that town from typhus fever, were attacked by the same disease, and no fewer than nine of the cases ended fatally."

So strongly have the needless dangers of exposure at funerals impressed the medical mind, that the Health Board of New York have now issued a circular recommending that no public or church funerals should be given to persons dying of either diphtheria, scarlet fever, measles, or whooping cough.

In Chicago, also, where scarlet fever and diphtheria have been severe this past winter, the recommendation of one hundred medical men in council was in these words:

"There should be no public funerals of any patient who has died of any infectious or contagious disease. Remember that the separation of the sick person from the well is the most certain means of preventing the spread of the disease."

A writer in the *Baltimore Physician and Surgeon*, last December, went so far as to advocate the passage of a law on the subject (the average American man looking upon a "law" as the cure-all on every occasion). He thought it should embody the following provisions:

1. Whenever any one dies of contagious disease, the publication announcing the death should state the cause of death.
2. No person except the immediate family should be permitted to attend the funeral, and the handling and burying the body should be intrusted to persons who devote themselves to that business.
3. A sufficient number of carriages should be kept for the special purpose of attending these funerals, and the hiring them for other purposes should be prohibited, under the severest penalties.

These are good suggestions, but people should learn and obey them out of a natural sense of sanitary propriety, not out of obligation to a statute.—*Medical and Surgical Reporter*.

On Vegetarianism.

A discussion on this subject took place at a recent meeting of the Medical Society of London. True vegetarians, it was urged, eat neither butter, eggs, nor milk.

Sir Joseph Fayrer related his experience of the effects of this diet among the natives of India, and said he had no doubt that people could live on vegetables alone. He had seen some of the finest specimens of the human race, as regards strength, power of endurance, and physical development, among the inhabitants of the northwest provinces of India, who were pure vegetarians; but he accounted for their condition from the fact that their food consisted chiefly of leguminous seeds, such as peas, beans, and the like, which contained a larger amount of nitrogen than other vegetables.

The President, Dr. Buchanan, remarked that in the discussion several factors should enter—as age, which was a considerable element, as no doubt people advanced in years appear to thrive on a vegetable diet, whereas children require almost a pure animal diet. Again, climate was a great factor; and in the treatment of disease it could be strongly advocated; while, lastly and chiefly, temperance must be strictly enforced, avoiding excess in the use of animal food, and taking, in fact, a middle course.

A Torpedo that Travels 275 Miles an Hour.

The most terrible invention for warfare that has ever been devised—if we may trust the reports of our English contemporaries—has recently been submitted to the Admiralty by a clergyman, the Rev. C. M. Ramus. The Whitehead fish torpedo has already proved its capability of travelling beneath the surface of the sea at the rate of 20 miles per hour; but the "rocket float," as the new machine is called, weighs 50 tons, and is propelled on the surface at the rate of 275 miles per hour for a distance of four miles. The apparatus is a timber or iron vessel, the bottom of which is a series of inclined planes. In the head is the explosive, and enough gun cotton can be carried to blow up the largest iron-clad in existence, while the rocket, by the combustion of which the craft is impelled, is laid along the deck. The vessel is said to be easily guided by a rudder of very thin sheet metal.

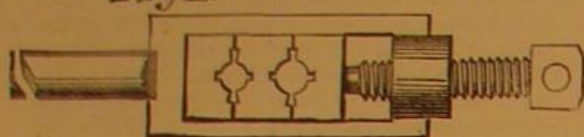
If the coming British experiments substantiate the foregoing, it would seem that armor-plated ships have had their day, and that the naval vessel of the future should be of cork.

[For the Scientific American.]
**A CURIOUS PIECE OF MECHANICAL MANIPULATION.—
 CUTTING RIGHT OR LEFT HAND THREADS
 WITH RIGHT HAND DIES.**

If there were any one mechanical operation that it would seem the height of absurdity to attempt to accomplish, it would appear to be that of cutting a triple left hand thread with an ordinary pair of right hand dies; but it has been done, and, indeed, is very easy of accomplishment.

A short time since Mr. J. J. Bingley, Master Mechanic of the Hanover Branch Railroad, wrote to me, saying that a workman in Hanover, Pa., had accidentally cut a treble left hand thread with a pair of right hand single thread dies, and requested a solution of the mystery. Upon request, Mr.

Fig. 1.



Bingley forwarded both the screw and the dies, and the mystery was readily solved, resolving itself into a mechanical operation which may in many cases be turned to excellent account. In Fig. 1 are shown the dies, and in Fig. 2

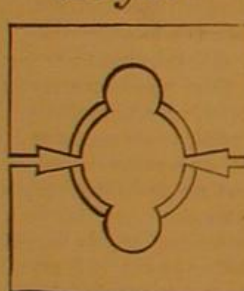
Fig. 2.



are a single right hand and a treble left hand thread cut with them. The machinist who cut the first treble left hand thread did so from a combination of manipulative errors, each one of which was necessary to his accidental discovery. First, the dies with which he operated were of a wrong shape, and secondly, the iron upon which he cut the thread was larger in diameter than such a pair of dies should be applied to; thirdly, he wound the dies the wrong way; fourthly, he put a pressure upon them in a direction wrong with relation to the direction in which the dies were wound upon the work.

Referring to the first point: Dies for use in hand stocks, that is to say, adjustable dies that are made in two pieces, and are intended to pass more than once along a thread before finishing it, should be, and are almost universally, cut with a hub or master tap larger in diameter than the bolt they are intended to cut threads upon, for the following reasons: In Fig. 3 is shown a pair of dies tapped with a $\frac{1}{4}$ inch master tap or hub, and in Fig. 4

Fig. 3.



is shown the same pair of dies, opened out and placed upon a $\frac{1}{4}$ inch bolt. Dies made in this manner, it will be observed, when opened out to take the first cut upon the bolt, have nothing to steady them, since only the very corners of the teeth contact with the bolt; and the sides of the thread and the length of the teeth of the die have a great deal of clearance upon the bolt, and the consequence is that they operate very unsteadily until the thread is cut to some depth upon the bolt. The edges of the teeth, at A and B, perform all the cutting duty; and as the thread approaches completion upon the bolt, the friction becomes very great unless the dies are given clearance in the thread. It is usual, therefore, to cut such dies with a master tap of larger diameter than that of the bolt upon which the dies are intended to operate. How much the excess of the diameter of master tap should be is a disputed question. In some cases an amount equal to twice the depth of the thread is used, and in others once that depth is preferred. The dies shown in Fig. 5 are twice the depth of the thread larger in diameter than the size of the bolt; and as a result, when placed upon the bolt, the teeth fit closely to it, and therefore operate very

Fig. 4.

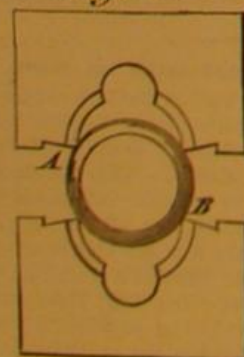
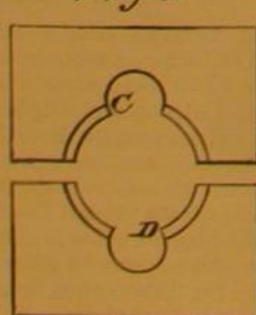


Fig. 5.



steadily, the cutting edges being in this case at C and D. It is obvious that here the dies require to close nearer together than would otherwise be the case; hence a piece of metal equal in thickness to, or rather more than, twice the depth of the thread is placed between the dies while they are being drilled and cut by the master tap. With dies cut in this manner, the sides and length of the teeth fit so closely to the thread, as shown in Fig. 6, as to preclude the possibility of their cutting a thread any different from that of their own

teeth, and the cutting edges are well supported by the metal behind them; whereas, in dies cut as shown in Fig. 4, the teeth are very liable to break off, as well as to dull very rapidly. Therefore it is that such dies are wrong in construction. The dies sent to us by Mr. Bingley are of this construction; and it will readily be perceived that, even when applied to bolts of the same diameter as the die itself, the teeth bear upon such fine points, and the back of them is so well clear that, by taking a very fine cut and putting a pressure upon them, they would act as chasers, well canted over; and they would travel in whichever direction the pressure determined. As the die teeth, however, enter the bolt, the sides of the thread would come into play, and would steady and force the dies to cut correct grooves.

These dies are tapped with about $\frac{1}{4}$ inch taps, and the iron upon which the right and left hand threads are cut is full $\frac{1}{4}$ inch in diameter; and as a consequence, we have the condition of things shown in Fig. 7, in which the very points of the teeth only have contact with the bolt. As a result, the thread may be cut the full depth, without the sides of the thread upon the bolt and those upon the die coming into contact at all. If, then, the dies are placed upon the bolt, and set to take a very light cut, the direction of the up or down pressure placed upon the dies will determine the direction in which the dies will travel and the thread be cut. If the dies are wound from right to left while pressed downwards, the thread cut will be a left hand one, and vice versa; and whether the thread so cut will be a single, double, treble, or quadruple one, depends upon the size of the bolt and the amount of the pressure; for though the size of the bolt may afford sufficient clearance to the sides of the die teeth to cut a quadruple thread, yet, if the vertical pressure placed upon the die moves it at the necessary speed, only a double thread will be cut. In other words, the thread cut will be in all cases proportionate to the amount of vertical movement of

Fig. 6.

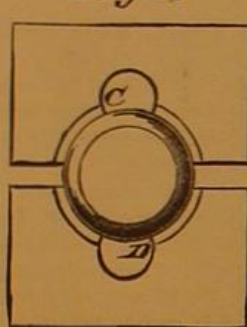
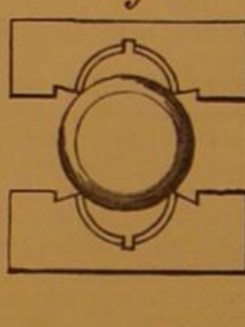


Fig. 7.



the dies. Of five threads cut with the dies shown in Fig. 7, three were treble left hand ones, one was a double left hand, and one a single right hand one. I find as a rule that the thread is apt to be as coarse as the clearance between the threads will permit; and this occurs because of the difficulty of judging the exact amount of vertical pressure necessary to cut any particular pitch. And since the pitch of the thread cut cannot in any event exceed such an amount as will bring the sides of the threads into contact, it becomes easier to cut that extreme pitch than any less one. In cutting the left hand threads, it is necessary to reverse the natural order of things by moving the dies backwards when the pressure is placed forwards, and vice versa. By a simple attachment to regulate the vertical motion of the dies when starting, the double or treble threads might be cut with accuracy and certainty.

J. R.

On the Use of Tannic Acid for Testing Potable Waters.

The importance of using pure water, in order to prevent disease and death, cannot be too frequently impressed upon the minds of the public. At all seasons, but more especially in the spring and summer months, persons who use well water are in danger of taking into the system the germs of typhoid and other fevers. These dangerous constituents seldom influence or mar the taste of the water, and are not suspected until they have lain one or more victims on a bed of sickness.

In a recent number of the *Journal für Praktische Chemie*, Hermann Kämmerer says, in regard to the reagents employed by chemists for testing potable water, that for the most part they merely show the presence in water of organic matter; but some kinds of organic matter may be present in large quantities without causing epidemics or sporadic diseases. Most methods for the chemical analysis of water do not determine the nature of the organic matter which is dissolved in the water, and, at most, a conclusion is drawn as to the presence or absence of nitrogenous organic matter from the odor emitted on charring the residues left by evaporation of the water. This is very uncertain, because the presence of two kinds of compounds frequently frustrates this distinction, or the presence of a large amount of nitrates prevents the production of the characteristic odor by completely oxidizing the compound.

For hygienic purposes, it is very frequently of the greatest importance to know whether water contains putrefactive matter, especially of animal origin, since the present state of Science points to these as the probable bearers or producers of the real causes of disease. Hence the introduction of reagents which shall enable us to detect animal matter with certainty, and also its approximate quantity, is exceedingly desirable when testing water for hygienic purposes. Käm-

merer believes that tannin or tannic acid is a very valuable reagent for this purpose. Tannin is really a group reagent for a large number of bodies of animal origin, which readily suffer decomposition or decay, such as albumen, gelatin, etc. These can easily find their way into the water of the soil, rendering it impure, and, according to our present views, must render such water very dangerous.

Tannin has been recommended before this as a test for water, but has as yet attracted but little attention, although Kämmerer proceeds to prove that it is very excellent for this purpose. He thinks it would be very interesting to prove directly whether putrefactive matter be present in well water which is near enough to receive the drainage of graveyards, factories where glue, blood, and similar substances are used, and in many other cases.

Lefort recently directed attention to the probable presence of gelatin or glue in water from churchyards. In an analysis of water taken from a well at a distance of ten rods from the churchyard of St. Didier, made by him in 1873, he obtained a residue, which, when boiled with hydrochloric acid, and on charring, emitted an odor which he thought could only be produced from glue. Lefort does not seem to have sought or obtained any further reaction characteristic of gelatin.

When analyzing three specimens of well water from a churchyard in St. Leonhard, near Nuremberg, Kämmerer observed a similar reaction of the residues of evaporation, and then tested the water directly by means of tannin. For this purpose 18 cubic inches of the water to be tested was placed in a glass cylinder; to each sample was added 0.18 cubic inch of a freshly prepared, cold, saturated solution of tannin, and left standing in vessels closed and airtight. The first sample instantly became cloudy by the separation of a rapidly increasing, curdling precipitate, which, at the end of an hour, formed a thick gelatinous precipitate, and after standing for days did not settle clear and colorless. The sample from the second well acted in a similar manner; at the end of an hour there was a heavy, gelatinous precipitate, which soon took a gray, then light green, and finally dark green color, due to a trace of iron in the water. The third sample retained its clear appearance a longer time, and in the first four hours only a slight turbidity could be observed, yet in 24 hours a thick starchy precipitate had formed. The organic nature of the precipitate was undoubted, but was further proved by charring it, when it gave off, like the residue from evaporation, a strong odor of burned horn, and left behind a very small amount of ash in proportion to its volume. For the purpose of testing for volatile organic acids, sulphuric acid was added to a few quarts of each sample of water, which was then distilled off to one fifth its original volume; a very small quantity of the tannin solution added to the residue caused an immediate coagulation to a stiff jelly also in the residue of the water from the third well, which, when treated directly with tannin, was not entirely precipitated for 24 hours. Since sulphuric acid precipitates tannin from its aqueous solution, and this precipitation looks milky and is difficult to clarify, it was thought possible that the strong reaction in these residues might be referred to the precipitation of the tannin by the sulphuric acid. But this supposition did not agree very well with the volume of the precipitate, which seemed disproportionately larger than the quantity of tannin employed. Comparative experiments were made with tannin precipitated by sulphuric acid, and gelatin precipitated by tannin, and showed that, on heating, the tannin dissolved in the sulphuric acid and water before it reached the boiling temperature, and, on cooling, was precipitated again and soon settled, leaving the liquid clear. The precipitate formed by tannin in a solution of gelatin is not dissolved by dilute sulphuric acid even when boiling, but seems rather to increase. The precipitate formed by tannin in the residues from distillation reacted precisely like the latter; on heating to boiling, they seemed rather to increase than to diminish.

After he had found, by further experiment, that the turbidity produced by tannin solution in the three samples of water were not caused by albumen, but by gelatin, Kämmerer feels that he is justified in drawing the following conclusions:

1. There can no longer be any doubt of the presence of gelatin in well water. In some cases it is found in comparatively large quantities.
2. Tannin is a suitable reagent for detecting this and similar substances, and this test ought never to be omitted in analyses of water for hygienic purposes.
3. The presence of salts and other compounds found in water may retard the precipitation by tannin. To judge of the purity of water from the tannin reaction, it must stand at least 24 hours.
4. Every water that suffers considerable turbidity with tannin must be held to be dangerous for drinking. It seems to make no difference whether the precipitate falls at once or only after some time, as the time depends less on the substance to be precipitated than on the other substances dissolved in the water which retard the precipitation.

Bichromate of Potash an Antiseptic.

M. Langeroy states that one per cent of bichromate of potash in water will prevent putrefaction in animal and vegetable substances immersed therein. Meat, after being kept in the solution for several months, becomes like gutta serena, and the author has struck medals from pieces of it. It is no longer eatable, however, and it is even said that dogs refuse to touch it.

Curiosities of the Railway Ticket Manufacture.

Chambers' Journal gives the following interesting account of how railway tickets are made at a celebrated factory in London, that of Waterlow & Sons:

Like many other great establishments, Messrs. Waterlow's has grown from a small affair to gigantic proportions. Beginning with law stationery, then advancing to account book manufacture, then to various kinds of commercial printing, it has gone on, step by step, until at present it gives employment to between three and four thousand persons.

One of the factories, consisting of a lofty building surrounding an open quadrangle, is devoted to ticket making and printing, chiefly railway tickets; and to the process as carried on there, we will now direct our readers' attention.

The paper for tickets is made of a slightly spongy texture, well fitted to take paste. It is known technically as middles, and is the foundation for two external surfaces of paper, white or colored as the case may be. The primitive paste-brush has long been discarded. A cleverly constructed machine pours out a stream of paste on two rollers, under or over which pass two sheets of paper, each of which becomes thoroughly pasted on one side. These are then quickly applied to the surfaces of the middle. The paste caldrons, in a compartment by themselves, have a vigorous appetite for flour, alum, and water, and pour forth volumes of steam. To show what "a bit of paste" may become when multiplied by millions, it will suffice to say that thirteen sacks of flour per week are used in this one factory! After the pasting, each sheet of cardboard, large enough for one hundred and twenty-five railway tickets, is, with others of the same kind, subjected to flat pressure, rolling pressure, and heat, until the surface papers are firmly and smoothly attached to the middle; exposure to a high temperature in heated chambers thoroughly dries them. Cutting machines sever the sheets into single tickets, the well known railway ticket size, all precisely alike in dimensions.

Next comes the printing. Messrs. Waterlow adopt four different commercial systems in the supply of these tickets. In the first system they manufacture the tickets throughout for the railway companies, who issue them ready for use to the booking clerks at the several stations. In the second, they partially print the tickets, leaving the companies to finish them according to the varying exigencies of the traffic. In the third, they sell the blank tickets, properly prepared and cut, to the companies; the printing in this case being wholly carried on by the companies. And in the fourth, they sell the machines to the companies, with a license to use them.

A pile of about five hundred blank tickets is placed in an upright tube or hopper, with just room to sink down readily. The bottom of the tube is open, allowing the lowermost blank to rest upon a flat metal plate. A slider, with a rapid reciprocating horizontal motion, strikes the lowermost blank dexterously aside to a spot where it can be printed on the back with those cautions, instructions, and references to by-laws which most companies deem proper to communicate to the public. Another sharp stroke drives the blank farther on, where the printing and numbering of the front or principal surface are effected. When the blank is printed on both surfaces, it is struck onward again, and comes underneath an exit or delivery tube, just the same height and dimensions as the hopper or feeding tube. Up this it is driven by a series of jerks, until a pile of (say) five hundred is finished. In traveling horizontally from tube to tube, and vertically up the delivery tube, each ticket acts as a kind of cardboard policeman, saying to its predecessor: "Move on, if you please." And they do move on, all undergoing some process or other at each stage of the movement. As the pile in one tube lessens, so does that in the other increase in height, like the two columns of liquid in a syphon. The whole pile can be removed from the delivery tube at once by a dexterous hand; but woe betide the luckless wight who "makes pie" (as the printers call the dropping and disordering of types in composing or distributing); for if a single ticket be disarranged, extra trouble is given in the after checking and correction.

As to the various colors displayed on railway tickets, some depend on the use of colored sheets of paper in the first instance; some on the production of stripes of color in a way bearing a resemblance to the making of colored stripes on earthenware or stoneware in the pottery districts; and some by a process more nearly resembling ordinary printing. One of the companies adopts a particular diagonal red line on all tickets, distinguishing them from other tickets which have to pass through the railway clearing house.

The automatic action of the machine or machines is very beautiful. For numbering each ticket, a peculiarly constructed wheel is used, which changes its particular digit every time a new blank is presented to it; and thus the consecutive numbers are produced on a series of tickets with unerring accuracy. A tell-tale index and a tell-tale bell, both automatically worked, give information as to the number of tickets printed, and the readiness of the machine to take in more food; but it is a matter of practical detail whether and when these tell-tales shall be deemed necessary. To give the reader an idea of how nicely this mechanism is adjusted, it refuses to work unless all the tickets are exactly of equal size, nicely squared, and in perfect order. It strikes one as being almost like a thing of life to see the machine detect a ticket from which a piece has purposely been torn off one end; its language is virtually: "Thus far shalt thou go, and no farther," for its prints as far as the defective ticket, and there stops.

As neither human fingers nor automatic machines are absolutely infallible, errors in numbering may occur in spite of all precautions. These are detected in a singular way. All the tickets in one series are made to pass through a machine with a velocity which the eye can scarcely follow. When stopped, the numbers are tested by two little index plates or wheels; if the same number is denoted on both indexes, all is well; but if any error has crept in, the index notifications differ, and afford means for determining at what part of the series the mishap has occurred.

A sheet of cardboard is certainly not a ponderous substance; but it is surprising how weighty the packages become when large quantities have to be dealt with. The tickets are tied up into small compact rows (string and tying being peculiar), and then packed into cubical masses in tin-lined boxes or cases—so firmly and closely pressed as to be as dense as a mass of wood. About fifty thousand tickets weigh one and a quarter hundredweight. The factory turns out two and a half millions of printed tickets (railway, steamboat, refreshment, etc.) per week, and ten millions of smoothly prepared but unprinted tickets; these numbers multiplied by the fifty-two weeks in a year, give a total annual production of something like six hundred and fifty millions, weighing upwards of sixteen thousand hundredweight! If these tickets be taken at two inches in length, and if they were laid flat, end to end, they would reach— But we leave our junior readers to exercise their arithmetical skill in solving this problem: merely hinting that it would require many voyages from England to America, and back again, to cover a distance equal to the length of this cardboard ribbon. From such small beginnings do great results ensue.

The Niagara Railway Suspension Bridge.

It is said that a curious spectacle is daily presented at the Railway Suspension Bridge, near Niagara Falls, N. Y. Whenever a passenger train arrives, weighing in all, say 150 tons, the passengers are ordered out of the cars and requested to walk over the bridge, on the pretence of better safety; but at the same moment, and while the passengers are on the bridge, the heaviest freight trains and locomotives, weighing 230 tons or more, are passing over the upper floor of the same bridge, directly above the heads of the passengers.

It appears that the Great Western Railway Company is the lessee of the bridge, for which, by agreement, they pay fifty-five thousand dollars a year rental to the Bridge Company. Owing to the fall in the price of materials, the Great Western might now build a new bridge, of their own, at a cost the interest whereof would be considerably less than the present rental. But the only way to escape this rent is to break the lease: which might be done if the bridge should be decided by the referees to be unsafe, not otherwise. The Bridge Company lately caused a most careful examination of the bridge to be made by several of the ablest engineers, whose report, recently published by us, showed that the structure was in splendid condition as to strength and safety. But the Great Western Company still aim to get a decision of the referees, one of whom they have appointed, one has been selected by the Bridge Company, while the third remains to be chosen by the other two. They have not yet been able to agree upon the third referee. In the meantime, it is supposed that the object of the Great Western Company in compelling the unfortunate passengers to bundle out and walk the bridge at every trip is to create a public opinion, in advance, against the safety of the bridge, in the hope of thus influencing in their favor the decision of the third referee, whoever he may be.

Transmitting Photographs by Telegraph.

A French *savant* has proposed some method by which a photograph may be transmitted from one place to another by the agency of the telegraphic wire; but we have not yet been able to learn anything of the means proposed to be adopted for securing so desirable an end.

We are, however, says the *British Journal of Photography*, in a position to give details of a method by which a photograph may be transmitted with the "speed of thought" to any part of the world with which the sender is placed in electrical communication. But this transmission is subject to compliance with certain modifications by which the original character of the picture, as a photograph, must be slightly altered, although this alteration is not necessarily any greater than that to which it has to be subjected before it meets the eye of the public as an engraving in any of our illustrated periodicals.

Rather more than twenty years since, Mr. F. C. Bakewell, the author of a well known treatise on "Electric Science" and other philosophical works, invented what he termed "the copying telegraph." By means of this system the very handwriting of the person who wrote a message could be transmitted in facsimile to his correspondent, all errors in transmission being avoided owing to the fact of the message being traced by mechanical agency from the original document. To render clear our description of a method by which a photograph can be telegraphed, it is necessary that we should give a brief account of Mr. Bakewell's clever invention.

Premising that paper can be prepared with certain chemicals (such as a solution of prussiate of potash and hydrochloric acid) which are decomposed by the passage of an electric current, the decomposition resulting in a visible mark at any or every place where a sharp point in the electric circuit is allowed to touch the paper, it will be readily comprehended that to bring such a sharp point in communi-

cation with the paper so prepared is a feat that can very easily be accomplished at a point distant thousands of miles. Mr. Bakewell's invention consisted in causing the communication to be written on tinfoil with an ink which was a non-conductor of electricity. The letters thus written formed on the surface of the metal a number of non-conducting marks. If, now, this sheet of tinfoil, previously trimmed to a definite size, be wrapped round a cylinder which will just suffice to permit of its going once round: If, further, this roller, placed in the electric circuit, be made to rotate at a definite rate of rapidity, and with a spiral or progressive motion from one end to the other in relation to a fixed point: it will be obvious that if this latter point be a needle mounted with sufficient elasticity to rise and fall as it passes over the heights and hollows of the letters which rotate underneath its point (which must be blunted so as not to scratch), a current of electricity will be transmitted to a distance which will be continuous only in the ratio of the immunity enjoyed by the ground, or tinfoil, from the breakages caused by the constant interruption of the non-conducting ink with which the message is written.

The drum or cylinder containing the communication being rotated, spirally, at one end of the telegraph wire, it now remains to be shown how the message is received at the other end. A cylinder, of precisely similar dimensions to that round which the communication is to be sent, must be ready at the receiving end of the wire, and round this must be wrapped a sheet of paper prepared in the way we have indicated. It, too, like the former cylinder, must be pressed upon with a needle-point tracer, and, like the original, it must also be made to rotate at a certain velocity previously determined upon, and, finally, it, too, must be made to move slowly from end to end, so that the point shall pass over it in a continuous line or spiral. It only now remains that, all things being ready, the clockwork be started, when the former roller will rotate under a point which is transmitting electricity subject to the interruptions caused by the letters of the message. As the paper on the receiving roller is traveling both in a circular and lateral direction at the same rate, it is evident that every touch of the tracer on the original communication will be rendered visible on the blank paper at the other end of the wire, the only difference being that, whereas the original communication is dark on a white ground, the message is received in light letters on a dark ground.

To transmit a photograph in accordance with the principle here laid down, it is first of all necessary that it be converted into lines. With our present knowledge of electrical communication, we must not expect the electric current to discriminate between thick and thin non-conductors; and until this has been achieved, if it ever will be, graduated tints must remain in abeyance. To convert a photograph—a portrait, for example—into lines, a print should be made on silver paper in the usual way, and this must be traced over with black ink, using a fine pen. When the tints have in this manner been translated into lines, the photograph is immersed in a diluted solution of bichloride of mercury in hydrochloric acid, by which the photographic image will disappear, leaving the pen-and-ink drawing only visible. If from this a negative be taken and a print in carbon be made upon a sheet of tinfoil, all the electrical conditions requisite for effecting the transmission of this drawing to any distance will have been complied with. The gelatin which forms the blacks, or lines, of the carbon print is a non-conductor; the base, on tinfoil, upon which the print has been developed, or to which it is permanently attached, is a conductor, and nothing else is required in order to effect the transmission of the picture in the manner we have described.

The accuracy of any likeness thus transmitted will depend upon two things: First, the fidelity with which the artist who is employed to make the pen-and-ink tracing effects his work; and, secondly, the adoption of such means as will insure both cylinders (the transmitting and receiving cylinders) rotating with a similar degree of speed—a matter involving no difficulty whatever.

DECISIONS OF THE COURTS.

United States Circuit Court—District of Connecticut.
FIRE ARMS PATENT.—THE UNITED STATES RIFLE AND CARTRIDGE COMPANY AND E. REMINGTON & SONS vs. THE WHITNEY ARMS COMPANY et al.

[Inequity.—Before Shipman, J.]

This was a bill in equity to restrain the defendants from an alleged infringement of letters patent granted to John W. Cochran on May 7, 1872, for improvements in breech loading guns. The plaintiffs are the owners of the patent, and E. Remington & Sons, for whose benefit the suit is brought, are the exclusive licensees thereunder. The answer of the defendants denies infringement upon their part, and also denies novelty of invention upon the part of the patentee, and alleges that the application of the said Cochran for a patent was filed on May 8, 1869, and that for more than two years prior to said date the invention had been in public use and sale with the consent and allowance of said Cochran, and that prior to the said date the invention had been abandoned to the public.

Held by the Court: The provisions of section 35 of the act of 1870, that upon the hearing of the renewed applications therein referred to, abandonment should be considered as a question of fact, does not render delay of itself conclusive evidence of abandonment, but makes the decision of such cases depend upon the peculiar circumstances as a question of fact and not of law.

The decision of the Commissioner in regard to the questions which have been committed to his exclusive jurisdiction is final—such as the sufficiency and competency of the formal acts and proofs which the statute provides shall be a prerequisite to the issuing of a patent; the existence of those facts upon which a release is to be granted or an extension made; and the sufficiency of the reasons for delay exceeding two years in prosecuting an application made since the act of 1870.

The granting of a patent is *prima facie* but not conclusive evidence that the right to the invention has not been surrendered to the public, and the same is true in regard to abandonment upon renewed applications which were made under the 35th section of the act of 1870.

All the defenses which the statute authorizes may be made as well in respect to patents granted upon applications renewed under the 35th section of the act of 1870, as in respect to those issued upon original applications. Lapse of time, *per se*, does not constitute abandonment.

The filing of an application is conclusive evidence that at its date the inventor did not intend to give his invention to the public, but it is not conclusive evidence that he did not subsequently do so.

Cochran's application was filed January 11, 1869, withdrawn February 20, 1869, and not renewed until after a period of eight years had elapsed. He, in the meantime, made numerous other inventions of a kindred nature, and obtained twenty-two patents thereon, constantly engaged in their development, and though poor, not thereby deterred from prosecuting his other inventions, and could have obtained a patent on this or at least kept the application alive had he so desired. Meanwhile the invention was

patented by others, and finally introduced in 1867, a year before Cochran filed his second application. Held: that while the new petition did not of itself sever the second application from the first, his acts and conduct show that the proceeding had been abandoned, and there was no continuity in the two applications.

The case distinguished from *Smith vs. Dental Vulcanite Company*, where the first application had never been withdrawn, and the inventor was unremitting in his endeavors to obtain a patent.

Forfeiture or abandonment may be inferred from the acts of an inventor who, without substantial reason or excuse, neglects the use of his invention and sleeps upon his rights for a number of years, while others in the meantime produce the same thing and give the public the benefit thereof; and the same is true whether the device be patented or had gone into use, without a patent.

A use for the mere purpose of competitive examination, experiment, and test, is not a public use.

Judge dismissed.

(*Frederick H. Hitts and George Gifford, for plaintiffs.*
Benjamin F. Thurston and John S. Beach, for defendants.)

Inventions Patented in England by Americans.

From March 31 to April 9, 1877, inclusive.

BOOT MAKING MACHINERY.—S. Henshall, Philadelphia, Pa.
CONTROLLING CRANES, ETC.—T. A. Weston, Stamford, Conn.
EXERCISING APPARATUS.—G. W. Wood, New York city.
EXHAUST NOZZLE.—T. Shaw, Philadelphia, Pa.
FLANGE MACHINE.—C. Miller et al., Pittsburgh, Pa.
LAMP GLOBE, ETC.—Meriden Glass Company, Meriden, Conn.
MOWER.—J. R. Parsons, Hoosick Falls, N. Y.
RECOVERING TIN FROM SCRAP.—N. S. Keith, Brooklyn, N. Y.
REFINING SUGAR.—F. O. Matthiessen, Irvington, N. Y.
ROVING TWISTER.—J. S. Kirks, Chester, Pa.
SCRAP BOOK, ETC.—B. J. Beck, Brooklyn, N. Y.
SHUTTLE.—D. H. Chamberlain, Boston, Mass.
STENCH TRAP.—J. H. Mackie, Oakland, Cal.
TIME GLOBE.—L. P. Jewett, Glen's Falls, N. Y.
TRIMMING BOOT HEELS.—J. H. Russell, Boston, Mass.
TRUNK, ETC.—W. S. Soule et al., Mass.

Recent American and Foreign Patents.

NEW HOUSEHOLD INVENTIONS.

IMPROVED COFFEE POT.

Richard L. Nelson, Orange Court House, Va.—This invention is an improvement upon that for which letters patent have been lately granted to same party. The objects aimed at in the present improvement are to render the former "drip attachment" more compact, to lessen the number of parts composing it, to reduce the cost of the same, and to lessen the time required for making coffee.

IMPROVED SCRUBBING MACHINE.

Peter Byrne, Jr., Norwalk, Wis.—This machine consists of a wheeled frame, carrying a reciprocating scrubber and mechanism for operating it; also a water holder, which is connected with the scrubber by a flexible tube, and a mop and pan, for taking up the water that has been used in the scrubbing operation. The machine is pushed about on its wheels, so that the floor is both scrubbed and mopped as the machine advances.

IMPROVED MOSQUITO NET FRAME.

Johann F. Volle, Houston, Tex.—This invention consists mainly in vertical posts or rods, swiveled to the head of a bedstead, and having horizontal arms to which the net is attached by means of sliding rings. The invention further consists in connecting the said arms by a crossbar or rod which is adapted to slide thereon, and to which the net is likewise attached in the same manner as to the swinging arms. The invention further relates to the peculiar arrangement of cords for adjusting or operating the swiveled posts and extending or retracting the net.

IMPROVED SPRING BED BOTTOM.

William M. Edmans, Troy, N. Y.—This invention consists in wire springs, bent into forked or branched form, having their ends turned upward, to enter the lower side of the end rails of the bed bottom. The upper outer corners of the end rails are rounded off, and the springs are curved inward above them. The ends of the springs are bent upward at right angles, to enter holes in the spring slats.

IMPROVED LAMP SHADE HOLDER.

Hiram L. Ives, Troy, N. Y., assignor to himself and T. Henry Dutcher, of same place.—This is an improved illuminating shade holder for lamps, by which different sized shades may be used, and a more perfect combustion and brighter light without the use of a chimney produced. The holder is made of inverted conical shape and of transparent glass, the angle of the sides being so arranged that the rays of light are reflected from the shade at the opposite side of the holder. The upper circumference of the shade holder is provided with two flanges, of which the inner flange is supported on an inclined collar, and slightly below the level of the outer flange, so that a shade seated on the inner flange will almost touch the outer flange and form a neater finish therewith.

IMPROVED KNIFE-SCOURING PAN.

David H. Cassel and George W. Zint, Crestline, O.—This is an improved pan for the convenient scouring of knives and forks; and it consists of a sheet metal dish or pan with inclined center plane or rest piece for the knives and forks, and a front partition, providing a receptacle for the scouring powder. The scouring powder is taken up and applied directly to the knife or fork, bringing always a fresh quantity in contact with the same as the spent powder is dropped from the rest piece into the spaces at both sides of the same. The inventor claims that the scouring of knives and forks is by this pan accomplished in a neater and more convenient manner, the pan forming a clean and readily available device for that purpose.

IMPROVED BUTTER DISH.

William H. Fitch, Brooklyn, N. Y.—This butter dish or plate is stamped up of a sheet-metal blank in the customary manner. The sides of the dish are made straight with outward inclination, and connected at the corners by outwardly projecting mouldings, which are thrown beyond the outside edge of the dish by narrow tapering sections, that extend at right angles, or nearly so, from the sides. This outwardly projecting section serves not only to stiffen the sides, but mainly for the purpose of providing for the surplus stock at the corners, and avoiding the creasing or wrinkling of the sides by the too large quantity of stock at the rounded off corners. The throwing or bulging out of the corners has the additional advantage of requiring less power in stamping the dishes, so that two or more may be stamped up by the same blow, and of producing a smooth, stiff, and durable dish of uniform appearance, and without the objectionable folds or creases that are generally found in sheet-metal dishes of this kind.

IMPROVED PROVISION SAFE.

Ezra Webb, Brooklyn, N. Y., assignor to Mrs. S. E. Shutter, New York city.—This invention is intended to be placed in a window when there may be a scarcity of closet-room, to receive cooked and uncooked provisions, and to be so constructed that it may serve also as a refrigerator. A safe has wire cloth in its front and back, so that the air may pass through it freely. The top of the safe is made inclined, so that the rain may run off it freely. The front of the safe may be provided with a single door or with double doors, as may be desired. In the bottom is placed a pan in which may be placed a rack to receive ice, shelves being placed in the upper part of the said compartment. The drip water from the ice chamber may be received in a pan or other receptacle, or may be conducted away by a pipe.

IMPROVED WASHBOARD.

William Serviss, Sidney, O., assignor to W. M. Serviss & Co., of same place.—This invention consists in making a washboard entirely of metal, the object being to provide a washboard that will not warp when subjected

to the action of hot water and soap, and that is light, durable, and easily repaired.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED FELLY.

William A. Wharton, Belle Centre, O., assignor to himself and H. E. Lambert, of same place.—In this invention, a section of felly, is made from malleable iron, or any other suitable metal, so as to present the same exterior form and appearance as the ordinary wooden felly; but from its peripheral or tire side it is chambered out to lighten and cheapen it. Holes are made in it to receive the spokes, and from one of its ends a dovetail projects, and in the opposite end a hole is made to receive the dovetail of the adjoining felly section. These holes may be provided in both ends of the felly section, and a pin or bolt used to connect the adjoining ends of the fellys, if desired. A block, having the same form as the transverse section of the felly, provided with a central opening for receiving the dovetail, is placed between the ends of the felly sections when the wheel is made; and when the spokes become worn, so that when it becomes necessary to contract the rim of the wheel, one or more of the said blocks may be removed and the rim contracted, so as to force the spokes farther into the hub when the tire is shrunk on.

IMPROVED FASTENER FOR MEETING-RAILS OF SASHES.

William T. Doremus, New York city.—This is an improved window sash stop, so constructed as to operate automatically to fasten the sashes when they are closed, so that it is impossible to close the window and leave the sashes unfastened, and which may be also used to lock the sashes, so that they will not shake and rattle with the wind. The invention consists in combining with a stop pivoted to plate, and having a toe, a pivoted lock plate having upwardly projecting inclined flanges and shoulders upon its sides. The stop is so formed that, when left free, its weight will cause its lower forward corner to project, so that when the upper sash is raised into place, or the lower sash is lowered into place in closing the window, the corner of the stop will be over the top rail of the said lower sash, and the window will be securely fastened.

NEW MISCELLANEOUS INVENTIONS.

IMPROVED COIN TRAY.

Albert A. Hyde, Wichita, Kan.—This is an improved tray for the use of bankers and others using large quantities of coin, to enable them to have the coin in a convenient shape, and to facilitate the removal of the coin from the tray when desired. The sides of the tray are attached to the side edges of the bottom, the lower parts of which project below said bottom to serve as feet, and are so formed as to give the bottom a slight forward inclination, to prevent the coin from falling out at the open rear side. The interior of the tray is divided into compartments by vertical partitions, which are attached to the bottom and the front. The partitions are so arranged that the compartments may correspond in width with the diameter of the coins to be placed in them. The bottom of the tray is graduated or made of different thicknesses, so that each pile of coin, when made level with the top of the tray, may contain even dollars, and may thus prove the count or render the counting of the full piles unnecessary. A handle is formed upon or attached to the rear edge of the bottom for convenience in handling the tray. A lifter is used for removing the piles of coin from the compartments of the tray. The forward end of the lifter is concaved to rest against the side of a pile of coin, and to the lower edge of the forward end of said coin-lifter is attached a thin metal plate, to be slipped beneath a pile of coin, so that the whole pile of coin may be removed at once when desired.

IMPROVED STATION INDICATOR.

John Peter Schmitz, San Francisco, Cal.—This apparatus is simple in construction, and operated by the driver of the street car, or brakeman of the steam car, on which it is placed. It indicates the streets or stations passed on the route by the names thereof appearing through a slot in the side of the case containing the endless traveling apron on which the names are printed. The apron passes around suitable rollers.

IMPROVED WATER ELEVATOR.

Abraham Vantrump, West Elkton, O.—The buckets on an endless chain empty into a trough above the platform, with exit-spout to keep up a steady stream. By reversing the motion of the elevator, the buckets are emptied, which is of advantage in summer, as there is no water wasted, and the same is always obtained fresh and cool, while it prevents in the winter season the freezing of the contents of the buckets.

IMPROVED COTTON CHOPPER.

John P. Harrison, Aberdeen, Miss.—This cotton chopper is so constructed as to chop the crop to a stand by being drawn across the field. The hoes may be adjusted wider apart or closer together, according to the number of stalks desired to be left.

IMPROVED LEVEL.

Thomas H. Burk, New York city.—This invention admits of convenient observation from top and side during use; and it consists of a level and plumb having indicators, which are operated by a weight hung to the center shaft of the side indicators, and working at the same time a top indicator by bevel gear connection. A vertically supported shaft, that passes through the top dial, carries an index hand at the upper end, which hand is in line with the side indicators when they are in vertical position, but follows the motions of the side hands in exact manner, so as to instantly indicate whether the rule is in level or plumb position or not. The joint working of the index hands facilitates the use of the implement, as the positions of the hands may be seen at a glance from the side or top without necessitating stooping down to observe the side indicators.

IMPROVED HORSE COLLAR.

Hezekiah W. Whitney and Charles F. Whitney, Oswego, N. Y.—This horse collar is from parts of peculiar form, secured together by means of rivets and stitching, so as to form a durable and comfortable collar. The face of the pad, or part of the collar that comes into contact with the horse's breast, is cut with a convex outer edge and a curved inner edge. The ends of the face part are cut diagonally to fit the other portions of the collar to which it is attached. The threads of the stitching draw the inner and outer surfaces of the collar together, forming one crease for receiving the hames, and another for relieving the pressure on the breast of the horse and preventing galling. A flat surface is formed for relieving the horse's breast from pressure. This surface is quilted to prevent it from becoming convex.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED WINDMILL.

Daniel Nysewander, Springfield, O.—This invention consists in the combination of two segmental gear wheels, two regulating vanes, and an adjustable weight with the turn-table and the main vane; in the combination of the flaring flanges with the edges of the wings of the wind wheel; in the combination of brace bars with the flanges and the wings of the wind wheel; and in the combination of upright bar, cross bar, hinge bar, and the vane. It is too elaborate an invention to be adequately described without engravings.

IMPROVED COTTON PRESS.

James Templeton, Florence, Ga.—The object of this invention is to furnish a hand power cotton press of cheap, simple, and effective construction,

by which the packing and baling of cotton or other material are facilitated and accomplished with less danger from the fulcrum lever. The invention consists of a lint box, filled from the top, and is operated by an upwardly moving follower and sliding top panel. The base frame of the cotton press is supported on cross sills, and provided with uprights that are braced in suitable manner to the base sills, and strengthened by lateral pieces, so as to form a strong and rigid support for the lint box. The lint box extends either through the floor of the building from the lint room down to the ground, or the same is provided, when the press is put up outside of the shed or building, with a platform around the lint box, at suitable height above the base frame or sill.

IMPROVED MACHINE FOR WINDING HAY INTO ROLLS FOR FUEL.

Ebenezer Harding, Delavan, Minn.—This machine winds hay or straw into rolls or twists for the purpose of using the same in a compact and convenient form for fuel; and the invention consists of a flat revolving spindle, in combination with a sliding and lever-actuated pressure roller, the hay being wound upon the spindle, which is withdrawn when the roll is finished. After the hay is attached to the spindle by being wound once or twice around the same, the spindle is revolved by one hand, and the roller pressed at the same time tightly, by the lever, with the other hand, against the hay, so as to form a closely wound roll of hay or straw, of any desired size, around the spindle. When the hay has the required size, the spindle is withdrawn, by pulling the crank sideways, and the roll removed. The next roll is then formed in the same manner, and thus any quantity of the surplus hay or straw is worked up quickly into rolls of compact shape, which may be used in convenient manner as fuel, in place of wood, and burned in any stove.

NEW AGRICULTURAL INVENTIONS.

IMPROVED CORN PLANTER.

Harrison Wagoner, Cohocton, O.—This planter is so constructed as to open a channel to receive the seed, drop the seed at uniform distances apart, cover the seed, and mark the rows, so that the planting may be done in accurate check row. By this construction the dropping slides are drawn back to drop the seed with a slow movement, and are pushed forward to again receive seed with a quick movement, so as to jar the seed and insure the filling of their dropping holes.

IMPROVED PLOW.

Robert B. Thomson, Dansville, Mich.—This plow consists of a combination of a mould-board, point, landside, forward standard, rear standard, and beam. The standards are made with bends or offsets near their upper ends, to bring the beam directly over the line of resistance. The upper end of the forward standard has a forward projection or arm formed upon it, through which passes the bolt that secures and pivots the beam to the said standard. Upon the upper end of the rear standard is formed a projection or plate, which is made in the form of a section of a circle. The forward edge of the plate is concaved, and has a flange formed upon its lower side to receive the hook of the hook bolt, which passes up through the rear end of the beam, so that by loosening the nut of the bolt the rear end of the plow beam may be moved from or toward the unplowed land, to adjust the plow to take or leave land, as may be desired. The colter is entirely independent of the beam, and may be adjusted up or down and toward or from the land, as may be desired. The handles are connected by rounds, the lower ends of which are secured to the landside and mouldboard by bolts, the upper bolts passing through slots, so that the rear ends of the handles may be raised and lowered to correspond with the height of the plowman.

IMPROVED CORN PLANTER.

Charles L. Goethals, Los Angeles, Cal.—This machine is so constructed as to open a furrow to receive the seed, drop the seed, and cover it. The new feature consists in the lever which works the dropping slide.

IMPROVED DITCHING MACHINE.

Thomas N. Turner and Sanford Turner, Rushville, Ind.—The sides of the ditch are cut by colters, the lower ends of which are attached to the forward corners of the share. The cutting edge of the share is made V-shaped, and its rear part is inclined upward, so as to deposit the dirt upon the endless belt of the elevator. With this machine a slice about six inches deep may be taken from the bottom of the ditch at each passage, and by passing back and forth a sufficient number of times the ditch may be sunk to any desired depth.

IMPROVED CORN SHELLER.

Herman Neubert, Ironton, O.—The forward part of the shaft is divided into four branches, to the outer ends of which is attached a ring plate. Upon the inner edge of the ring plate are formed four knives, the edges of which are inclined, and which are bent into such a shape that their said edges may rest upon the ear diagonally. To the branches of the shaft, at a little distance from their ends, is attached a ring plate, upon the inner edge of which are formed lugs which are bent forward at right angles to extend along the ear longitudinally. A tube keeps the kernels from scattering as they are removed from the cob by the knives and lugs.

IMPROVED HAND CORN PLANTER.

William E. Seelye, Anoka, Minn.—The lower part of the front of the seed chamber is formed of a spring plate, which will spring inward to close the chamber when a plunger is raised, and is pushed outward to allow the seed to drop into the ground when the said plunger is pushed down. The plunger is attached to the lower end of a bar, that slides up and down upon the inner surface of the back of the chamber and seed box, and is connected with the lower end of a handle which slides upon the outer surface of said back by two bolts. The bolts pass through a longitudinal slot, formed in the back of the planter and through a block or blocks placed in the said slot. The block or blocks keep the bar and handle at the proper distance apart, and also prevent the side edges of the bar from wearing the sides of the chamber.

IMPROVED CORN-GUARD FOR PLOWS.

Edward B. Murphy and Charles D. Bramell, South Point, Mo.—This is an improved device for attachment to the beams of plows to prevent soil and clods from being thrown against the young plants. It is a hollow cylindrical casting, made with its outer end closed, and upon the upper and lower sides of which are formed lugs to receive bolts which pass above and below the plow beam and through the ends of a bar placed upon the other side of the said beam, so as to clamp it between the said casting and bar. A spring holds the guard plate down to the ground and, at the same time, allows it to rise to pass over an obstruction. The device may be attached to the beam of a shovel plow, a turn plow, or any other desired kind of a plow.

IMPROVED CORN PLANTER.

H. William Meyerhoff, Waverly, Iowa.—This invention relates, first, to the means for changing the angle of the tongue to the frame of the planter, for the purpose of varying the depth at which the furrow-openers deposit the seed in the ground; secondly, to the mechanism for reciprocating the seed slides, and the arrangement of a clutch for throwing the same into, and out of gear with one of the transporting wheels; and, thirdly, to making the driver's seat adjustable by a particular construction.

IMPROVED PLOW.

Daniel P. Ferguson, Jonesborough, Ga.—This invention is an improvement in the class of plows having pivoted adjustable standards, and it relates to the employment of a curved or angular notched brace for the plow standard, and a weighted key for confining the brace. The invention further relates to the provision of a slotted stay-piece for preventing the share or shovel turning on the bolt by which it is attached to the standard.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion. If the Notice exceeds four lines, One Dollar and a Half per line will be charged.

Wanted.—The address of Manufacturers of Small Patent Articles, such as Toys, etc. S. Potts, W. S. S. "Intrepid," Navy Yard, New York.

Lithographic Stone Grinders. Simplest, cheapest, and best in use. Send for illustrations and testimonials. Frank Thomas & Co., Home St., Cincinnati, O.

Steam Yachts for sale, new, 14 feet long, 4 feet beam, 4 h. p., \$350; 18 feet long, 4½ feet beam, 1 h. p., \$355; 21 feet long, 5½ feet beam, 2 h. p., \$425. Shipping weights 450, 600, and 1,200 lbs. Will carry comfortably 4, 8, and 12 persons. Send for particulars. S. C. Forsyth & Co., Manchester, N. H.

Emery Grinders, Emery Wheels, Best and Cheapest. Hardened surfaces planed or turned to order. Awarded Medal and Diploma by Centennial Commission. Address American Twist Drill Co., Woonsocket, R. I.

For sale cheap—Two valuable Patents (Household Articles). Address J. A. Worley, Cleveland, O.

Parties having Room and Power, favorable located, and would like to assist in establishing a profitable Manufacturing business in the Hardware line, are requested to address for particulars, P. O. Box 431, Athol, Mass.

Diamond Planers. J. Dickinson, 64 Nassau St., N. Y.

For Sale—33" Lathe, \$350; 5 ft. Planer, \$250; 25" Lathe, \$150; 26" Lathe, \$250; at Shearman's, 132 N. 3d St., Philadelphia, Pa.

Iron Circular Saw Tables. An incomparable tool for shop work. Prices reduced. Illustrated circulars. Paterson, N. J. W. H. Havens.

For Sale.—21 in. 10 ft. Lathe, \$190; 17 in. 8 ft. do., \$175; 16 in. 10 ft. Wheeler do., \$225; 18 in. 5 ft. do., \$95; all back geared and screw cutting. 2 No. 5 Steam Pumps, \$75 each; 5 ft. Whitcomb Planer, \$225. Shearman, 132 N. 3d St., Philadelphia, Pa.

New Steam Yacht for sale, 35' x 6' 10"; also Yacht Engines, Propellers, etc. Wm. J. Sanderson, 21 Church St., Syracuse, N. Y.

How to make Violins. Write to J. Ranger, Syracuse, N. Y.

Platform Clothes Wringer, Centennial Prize Medal Awarded for being "perfectly self-regulating, and well fitted for the purpose intended." License to manufacture granted. J. K. Dagdale, Richmond, Ind.

Glass Cylinders Tempered in Oil. T. Degnan, 129 Milk St., Boston, Mass.

Practical Plumbers wanted as Agents for Improved Hydraulic Engine (highest Centennial award) for Blowing Organs. Address H. L. Roosevelt, Church Organs, New York.

600 New and Second-hand Portable and Stationary Engines and Boilers, Saw Mills, Wood Working Machines, Grist Mills, Lathes, Planers, Machine Tools, Yachts and Yacht Engines, Water Wheels, Steam Pumps, etc., etc., fully described in our No. 11 list, with prices annexed. Send stamp for copy, stating fully just what is wanted. Forsyth & Co., Machine Dealers, Manchester, N. H.

For Sale.—Combined Punch and Shears, and Engine Lathes, new and second-hand. Address Lambertville Iron Works, Lambertville, N. J.

Gas lighting by Electricity, applied to public and private buildings. For the best system, address A. L. Bogart, 702 Broadway, N. Y.

Power & Foot Presses, Ferracuto Co., Bridgeton, N. J. Superior Lace Leather, all sizes, cheap. Hooks and Couplings for flat and round Belts. Send for catalogue. C. W. Army, 148 North 3d St., Philadelphia, Pa.

F. C. Beach & Co., makers of the Tom Thumb Telegraph and other electrical machines, have removed to 530 Water St., N. Y.

For Best Presses, Dies, and Fruit Can Tools, Bliss & Williams, cor. of Plymouth and Jay Sts., Brooklyn, N. Y.

Lead Pipe, Sheet Lead, Bar Lead, and Gas Pipe. Send for prices. Bailey, Farrell & Co., Pittsburgh, Pa.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing metals. E. Lyon & Co., 470 Grand St., N. Y.

Solid Emery Vulcanite Wheels.—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, N. Y.

Amateur Photographic Apparatus, Chemicals, etc. Complete outfits, \$5 to \$25. E. Sackmann & Co., manufs., 273 Pearl street, near Fulton street, New York.

Consumption Cured.—An old physician retired from active practice, having had placed in his hands by an East Indian missionary the formula of a simple vegetable remedy for the speedy and permanent cure for Consumption, Bronchitis, Catarrh, Asthma, and all Throat and Lung affections, also a positive and radical cure for Nervous Debility and all nervous complaints, after having thoroughly tested its wonderful curative powers in thousands of cases, feels it his duty to make it known to his suffering fellows. Actuated by this motive, and a conscientious desire to relieve human suffering, he will send, free of charge to all who desire it, this recipe, with full directions for preparing and successfully using. Sent by return mail by addressing with stamp, naming this paper, Dr. J. C. Stone, 32 North Fifth Street, Philadelphia, Pa.

Steel Castings from one lb. to five thousand lbs. Invaluable for strength and durability. Circulars free. Pittsburgh Steel Casting Co., Pittsburgh, Pa.

For Solid Wrought Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

Shingle Heading, and Stave Machine. See advertisement of Trevor & Co., Lockport, N. Y.

Skinner Portable Engine Improved, 2 1/2 to 10 H. P. Skinner & Wood, Erie, Pa.

At half price—fine cold-rolled shafting; 425 feet, 3 1/4 to 4 inch, with hangers and taper sleeve couplings; good as new. Address Taper Sleeve Coupling & Wooden Pulley Works, Erie, Pa.

Yacht and Stationary Engines, 2 to 20 H. P. The best for the price. N. W. Twiss, New Haven, Conn.

To Clean Boiler Tubes.—Use National Steel Tube Cleaner, tempered and strong. Chalmers Spence Co., N. Y.

Split-Pulleys and Split-Collars of same price, strength and appearance as Whole-Pulleys and Whole-Collars. Yeom & Son, Drinker st., below 147 North Second st., Philadelphia, Pa.

Notes & Queries.

It has been our custom for thirty years past to devote a considerable space to the answering of questions by correspondents; so useful have these labors proved that the SCIENTIFIC AMERICAN office has become the factotum, or headquarters, to which everybody sends, who wants special information upon any particular subject. So large is the number of our correspondents, so wide the range of their inquiries, so desirous are we to meet their wants and supply correct information, that we are obliged to employ the constant assistance of a considerable staff of experienced writers, who have the requisite knowledge or access to the latest and best sources of information. For example, questions relating to steam engines, boilers, boats, locomotives, railways, etc., are considered and answered by a professional engineer of distinguished ability and extensive practical experience. Inquiries relating to electricity are answered by one of the most able and prominent practical electricians in this country. Astronomical queries by a practical astronomer. Chemical inquiries by one of our most eminent and experienced professors of chemistry; and so on through all the various departments. In this way we are enabled to answer the thousands of questions and furnish the large mass of information which these correspondence columns present. The large number of questions sent—they pour in upon us from all parts of the world—renders it impossible for us to publish all. The editor selects from the mass those that he thinks most likely to be of general interest to the readers of the SCIENTIFIC AMERICAN. These, with the replies, are printed; the remainder go into the waste basket. Many of the rejected questions are of a primitive or personal nature, which should be answered by mail; in fact, hundreds of correspondents desire a special reply by post, but very few of them are thoughtful enough to inclose so much as a postage stamp. We could in many cases send a brief reply by mail if the writer were to inclose a small fee, a dollar or more, according to the nature or importance of the case. When we cannot furnish the information, the money is promptly returned to the sender.

A. B. W. should put his questions as to saw and shingle machines into comprehensible language.—T. J. P. will find directions for setting a boiler on p. 339, vol. 33.—J. G. E. and many others are informed that there is no formula for the horse power of a boiler.—E. L. N. will find directions for the decalcification process on p. 275, vol. 34.—O. C. S. can gild the devices on china ware. See p. 43, vol. 29.—R. T. C. does not give sufficient data as to the wire becoming brittle by exposure to the atmosphere.—T. W. will find directions for making oxygen on p. 75, vol. 32.—A. H. (of Niedergrund, Bohemia) can cut gas retort carbon with a hand saw.—L. F. C. should give his tin plate a coat of oil paint, and let it dry. He can then fasten cloth to it with waterproof glue; see p. 43, vol. 32. For a description of the compound engine, see p. 243, vol. 32.—D. McI. will find on p. 218, vol. 34, directions for making the so-called eggs of Pharaoh's serpents. Asbestos is regularly advertised in our columns.—W. G. W. will find directions for nickel plating on p. 235, vol. 33.—J. O. F. will find instructions for making friction matches on p. 75, vol. 29.—C. W. will find a recipe for a cement for mending crockery and glass on p. 379, vol. 32. For mending leather shoes, see p. 119, vol. 28; for mending rubber boots, see p. 203, vol. 30.—H. C. B. is informed that tattooed marks on the arms are done with gunpowder or Indian ink. For removing the marks, follow the directions on p. 331, vol. 30.—S. H. will probably find that any good cheese, that is soft, will do to make cement.—S. will find that the cement described on p. 80, vol. 31, does not dissolve in water and does not become brittle with age.—J. M. McG., Jr., should read Paddlefast's articles on boat building in the SCIENTIFIC AMERICAN SUPPLEMENT.—H. & R. can dissolve rubber by the process described on p. 119, vol. 28.—J. W. S. can sensitize a piece of paper or metal by the process described on p. 132, vol. 35. As to changes of color by heat, see p. 201, vol. 35. As to a weather glass, see pp. 35, 67, vol. 36.—P. does not give sufficient data as to the hammering in his boiler.—W. C. P. is informed that the preparation is to be taken internally. The human hair is referred to in the question.—T. S. will find directions for fastening rubber to iron on p. 409, vol. 31.—S. R. C. will find a description of a gyroscope on p. 91, vol. 31.—T. K. & B. should know better than to believe in the possibility of an instrument indicating where gold lies buried in the earth.—C. W. K. is mistaken as to the horse power of the engine. See p. 33, vol. 33.—W. T. K. can bleach ivory by the process described on p. 10, vol. 32.—W. S. will find answers to all his queries as to lightning rods on p. 377, vol. 35.—H. R. will find directions for silver-plating without a battery on p. 399, vol. 31.—R. M. will find a formula for the power of an engine on p. 33, vol. 32.—A. I. will find on p. 123, vol. 31, directions for bluing gun barrels.—W. A. W. will find something on the expansion of mercury by heat on p. 354, vol. 36.—O. B. A. G., A. J. B., J. C., R. D., E., F. J. W., N. B., A. P. Q., F. J. N., R. B., C. W., F. C., W. L. McI., A., C. A. R., D. H., H. L., and many others, who ask us to recommend books on industrial and scientific subjects, should address the booksellers who advertise in our columns, all of whom are trustworthy firms, for catalogues.

(1) W. W. H. asks: Please tell me the ultimate weight that the two following girders will bear? One is a cast iron girder, nearly of the Hodgkinson proportions, 7 inches wide at base and 8½ inches high; and the other is a wrought iron girder of flat bar size, 5 inches x ¼ inch. Both girders being fixed and anchored in strong walls, and the span 20 feet. Please give an arithmetical and not an algebraic calculation. A. Calculated by the usual formulas, the center breaking loads would be: Cast iron beam, about 3,000 lbs., wrought iron beam, about 2,300 lbs.

(2) F. A. B. asks: What is the weight of a missile, and the greatest distance that the bolt could be thrown by the large Krupp gun, that was on exhibition at the Centennial? A. Weight of ball, 1,300 lbs. Probable range, between 4 and 5 miles.

(3) F. B. asks: 1. As a boy swings a bucket of water over his head and it does not fall out, how fast would a 10 foot flywheel with globular cavities on inside rim facing center of wheel have to turn to hold balls of any substance dropped or placed in them? Would there be a different effect if the balls were composed of different materials, as wood, stone, or iron? A. About 25 revolutions a minute, whatever the material. 2. On the principle of a top, a heavy wheel can be turned readily after starting. What difference will it make if, instead of a wheel, it should be as a large governor with heavy balls on arms 8 or 10 feet long, and how much more power would have to be expended to raise those balls on a spiral incline to near the level of their attachments? A. The height of the balls varies as the square of the revolutions. 3. Suppose a perpendicular shaft, moved by cog or belt gears, had four or more balls suspended by chains instead of stiff arms, would they not assume a similar position? A. Yes, other things being the same. 4. Suppose a tube arranged to turn and describe a circle, with outer end closed, but with an opening below, no wider than the cross section of tube, but giving perpendicular surface enough for a ball to rest against, if the ball could be held there by springs or otherwise until great velocity was acquired and then released, would it not remain there? A. Yes, as we understand your meaning. 5. I have seen a performer manipulating a top which at one time appeared to turn when standing out at right angles from the perpendicular stick that supported it. What held it up? A. Centrifugal force, which was enough to overcome the attraction of gravitation. 6. Does such a top weigh any less acting in that position than when at rest? A. No; it weighs just as much when revolving as when not.

(4) H. T. P. asks: Which has the most steam-generating capacity, and which is capable of the greatest resistance, a single boiler 60 inches in diameter and 18 feet long, or two boilers each 36 inches in diameter and 18 feet long? A. Generally, the two smaller boilers would make the most steam and sustain the greatest pressure.

(5) A. S. D. says: I have a canal about two miles long, which I use as a head race for water power. It runs along the foot of a hill and heavy rains wash dirt into it. How can I clean it out without drawing off the water? A. It would probably be necessary to use a dredging machine.

(6) W. O. R. asks: What is meant by the pitch of a steamer's propeller being 3 feet? A. It means that, if the propeller were working without slip, like a screw in a nut, the vessel would advance 3 feet at each revolution.

(7) J. A. O. Q. asks: Does not the Great Eastern consist of three complete ships? A. No; but the vessel is built with a double hull, and is divided by bulkheads into several compartments.

(8) W. D. S. says: Three men want to carry a bar of iron 9 feet long, weighing 300 lbs. One man carries an end. At what distance must the other two place a bar so that an equal weight (or 100 lbs.) will fall on each man? A. Three feet from the other end of the bar, if it is uniform in section.

(9) J. T. H. asks: Is tallow a good lubricant for cranks making 200 revolutions? Would oil be better? A. Oil is generally better than tallow for crank pins, and there are some special forms of lubricants that answer very well for crank pins and journals moving at a high velocity.

In an engine (double and vertical) 9 x 12 inches, making 300 revolutions, with a hand wheel 4 feet in diameter by 14 inches face and 3 inches thick, would there be any danger of breaking the wheel by placing a weight sufficient to balance weight of pistons? A. We think there will be no danger in attaching the counterbalance.

(10) W. M. K. says: What is the rate of increase of friction in proportion to speed of a thin smooth body (such as a propeller blade) in passing through water? What proportionate amount of power would be required to double any given number of revolutions of a fixed submerged screw propeller? A. Within moderate limits, the power is supposed to vary approximately as the cube of the number of revolutions, but the exact law of the variation is not definitely settled; and when the speed becomes very great, the power is supposed to increase in a higher ratio than the cube, but experiments have not been sufficiently extended to establish a general law.

(11) G. B. says: Two bodies of metal of equal weight are to slide over a planed surface. One of these bodies has a bearing surface (supposed to be a perfect friction contact), upon the table it slides on, of 6 square feet; the other body has a bearing surface of only 6 square inches. Will it require more power to slide the body having 6 square feet bearing than it will to slide the one having only 6 inches, or will the required moving power be equal? A. According to the commonly accepted law, the friction depends upon the weight and not upon the area of contact. This rule, however, has some limitations, especially when the area of contact is so small that the pressure per square inch is sufficient to produce abrasion.

(12) H. D. M. asks: Is the phosphorus lamp described on p. 396, vol. 31, of any use? A. The phosphorus lamp may be made and used as directed in the answer, but the light which it emits is extremely weak—a mere phosphorescent glow. It is sufficient, however, in a damp atmosphere, to illuminate the dial of a watch, held close to it, so that with ordinary eyesight the time may be noted in the absence of other luminants without much difficulty.

(13) S. asks: Is there anything that will erase India ink lines from drawing paper? A. Nothing that we know of, except a good steel eraser or sanded rubber.

(14) R. H. & Co. say: 1. In our business we use brads with malleable cast iron heads, for the support of lightning rods, and we galvanize them to prevent rusting. When we use them, we find the cast iron so brittle that a great many of them break. We can come to no other conclusion than that the galvanizing makes them brittle. Are we right? A. Galvanizing

Iron does not make it brittle. 2. Is it necessary to throw articles that are galvanized into cold water immediately after taking out of the vat? A. No. They should not be thrown into cold water.

(15) B. F. A. asks: How can I stain wood blue, the shade of the field in the American flag? A. Brush it over with a strong, hot solution of nitrate of copper in water, and then go over the work with a hot solution of carbonate of soda (2 ozs. to 1 pint water). 2. Boli 1 lb. indigo, 2 lbs. wood, and 3 cns. alum in 1 gallon water, and apply with a brush.

(16) C. M. T. asks: What will make photograph paper so transparent that it can be painted in oil colors on the back of a picture, so as to give a life-like color to the picture, or what preparation will make the paper perfectly transparent? A. Try Canada balsam. Paper cannot be made perfectly transparent—only translucent.

(17) C. D. H. says: Our water supply is from springs, and is soft. About two years ago, plain iron pipes were laid; and the 1 inch pipes have become so filled with a very hard rust or scale as to nearly cut off the supply. It forms in irregular masses, and adheres very firmly to the pipe. Is there any known method of preventing or removing the same without taking up the pipe? A. We do not know of any practical method for accomplishing this.

(18) C. K. asks: Can a good polish be put on copper by the recipe given on p. 236, vol. 32, and will it last a reasonable time? A. The recipe has been well recommended. It is better to use a larger proportion of alcohol than is there indicated. See also p. 242, vol. 34.

(19) B. C. M. asks: How is pyrolygneous acid (wood vinegar) made? A. It is obtained by distilling wood in iron retorts, resembling those used for making illuminating gas. The condensed products of the distillation contain, with tar and numerous other bodies, crude pyrolygneous acid or wood vinegar, amounting in a well conducted distillation to about 7 or 8 per cent of the wood employed. The gas that accompanies the liquid distillates is conducted to the furnace under the retort, and serves to continue the distillation without other fuel. In purifying the acid, it is first saturated with lime, evaporated to dryness, roasted at a moderate temperature so as to free it from volatile matters, and decomposed in a retort, having a helm of copper and a condenser of tin or silver, with hydrochloric acid (90 parts acid to 100 acetate of lime), and the acetic acid distilled.

(20) G. B. L. says: I built an oil house last fall, and lined it inside with inch boards, packing space between inside and outside boarding with pine sawdust. The oils on hand are coal oil, linseed, fish, elephant, seal, etc., also turpentine and benzine. The leakage from barrels seems to have thoroughly saturated the floor, and most likely the sawdust has absorbed whatever came in contact with it. Is there any danger of spontaneous combustion during the heat of summer? A. Yes, it is dangerous.

(21) A. H. says: Your correspondent, P., p. 212, vol. 30, seems to overlook the fact that a lightning rod having the deep earth terminal generally recommended by scientific authority, and which he does not favor, would, at the same time, have all the advantages of a rod terminating "at or just beneath" the surface, such as I understand him to recommend. For, before reaching the deep terminal, the rod would come in contact with the surface of the earth; and if the electricity find there or elsewhere a better conductor, the greater portion of it would leave the rod for that conductor, instead of following the rod to the end. With a properly constructed rod, terminating with an extensive metal surface, buried in contact with such worthless scraps of metal as the clippings from tinshops, old tinware, etc., or fine charcoal, or both, in constantly (not "almost always, during a thunderstorm") moist earth, which in many instances would be most easily found in the cellar bottom; there is little probability that the electricity will leave the rod to "pass off on the wet surface" or do damage.

(22) J. P. says, in reply to D. W.'s query as to the sudden welding of a millstone spindle to its step: In the New York Journal of Commerce, in the first year or two of its publication, may be found an account of a similar occurrence. A spindle (I think it was of a millstone) was suddenly welded to the support upon which it was running, in the very same manner, as in the case mentioned in your paper. I believe it occurred in the year 1827, or the first half of 1828.

(23) W. D. says, in reply to D. W.'s query as to the welding of a millstone spindle to its step: I have seen this done a good many times. To prevent it, plane a groove in the step ¼ inch wide and ¼ inch deep; harden the foot of the spindle and step as hard as possible, polish both after hardening, and you will have no trouble about welding together. The oil running through the groove prevents its welding. Use the best of sperm oil, and keep the step level.

(24) W. W. T. says, in reply to the query about the welding of mill points to their steps: I have had several such jobs to repair. The weld is perfect, and has always broken when struck in a different place from the point of union. I have to anneal the step and turn off the part of point left; and I find no check or line marking the place of contact.

(25) B. A. J. says, as to the sudden welding of a mill spindle to its step: I once had a spindle act in the same way while running in a cup of oil.

(26) W. C. says: Please give me a recipe for making powder for mining coal? A. Coarse-grained gunpowder is usually employed. The materials are first perfectly dried and separately reduced to impalpable powders. These are then sifted together, moistened with water, and ground for some time between large millstones kept constantly moist with water. The wet powder is then collected into large lumps and carefully dried. These lumps are grained by bringing them in contact with sharp teeth fixed upon the periphery of a revolving wheel, and agitating in suitable sieves to separate from the finer powder. The powder consists of 76 parts of niter, 13 parts of charcoal (often mixed with a little wood pulp or sawdust), and 11 parts of sulphur.

(27) J. R. Y., Jr., asks: Please give me a recipe for a wash that will remove or hide marks and stains on hard finished house walls. A. We do not know of anything better than clean water to wash them. Sometimes it is necessary to cover them with kalsomine. With bad stains over a large surface, it is best to take off the hard finish and renew it carefully in those places.

(28) C. D. R. asks: Please give me recipes for making turpentine japan or paint dryer, benzine japan or paint dryer, and rubbing varnish for cabinet makers' use? A. For turpentine dryer, take linseed oil 1 gallon, put into it gum shellac $\frac{1}{4}$ lb., litharge and burnt Turkey umber each $\frac{1}{4}$ lb., red lead $\frac{1}{4}$ lb., sugar of lead 6 ozs. Boil in the oil until all are dissolved, and stir in 1 gallon spirits of turpentine. For benzine dryer, take linseed oil 5 gallons, add red lead and litharge each $\frac{1}{4}$ lb., raw umber $\frac{1}{4}$ lb., sugar of lead and sulphate of zinc, each $\frac{1}{4}$ lb. Pulverize, and boil in the oil as before. When a little cooled, thin with benzine, 5 gallons. For rubbing varnish, use a solution of pure, bleached shellac in alcohol, and apply with a smooth wad of cotton cloth, and a drop or two of oil.

(29) J. H. R. asks: What is the advantage of placing the high pressure cylinder of a marine compound engine directly above the low pressure cylinder? A. All builders do not adopt this plan. Without being able to speak officially for those who do, we imagine that they consider the principal advantages to consist in economy of space and weight.

(30) W. K. D. says: I have an acquaintance who has an open fireplace in his office, and claims that during the forenoon the sun comes into the room and deadens the fire. Is this true, and what is the cause? A. We do not believe it is true, but probably the effect of deadening is produced to the eye by the sun outshining the fire.

(31) J. A. C. says: I have a boiler made of first class iron, which commenced leaking in one of the joints. This continued until every joint was leaking. We then patched the seams, but in a short time the leaking commenced again. The water for our boilers was pumped from a well into a tank, and was then warmed by having the exhaust pipe extend into it. Our boiler maker says that the leaking was caused by the oil which was carried from the cylinder by the exhaust pipe into the water in the tank and thence into the boilers. If this is not so, please give me the correct reason? A. You do not send sufficient particulars to enable us to form a decided opinion. The boiler maker's explanation points to a possible cause, while it is more likely that the trouble is due to faulty construction, careless management, or to the use of bad water.

(32) W. E. W. asks: 1. How can I tell the weight of a flywheel where I know the diameter, width of face, and thickness of same? A. Multiply the number of cubic inches in the wheel by 0.2604, to get the approximate weight in lbs. 2. Is there a rule by which the weight of a wheel is regulated for any given horse power? A. No general rule for the size of flywheel will answer under all circumstances. We could not treat the matter satisfactorily in these columns. You will find a good discussion in Rankine's "Machinery and Millwork."

(33) J. E. C. says: I see it stated in an article on machine belts, in the SCIENTIFIC AMERICAN for 1876, p. 331, that a belt wrapped one quarter round a pulley has only one fourth the power of what it would have if wrapped one half round. As an illustration of the above is given a man with a rope taking turns round a post, and states what a great power is gained according to the number of turns the rope is taken around the post. I have also known of pulleys being increased in diameter, so as to make the belt stick better and thereby have a greater power. But according to one of the laws of friction increase of surface does not produce increase of friction. How do you account for the power gained in the above cases? A. This is not contrary to the laws of friction in relation to bodies that are flexible. In these cases, it is shown that the friction depends on the angle of contact. You will find the matter discussed in treatises on applied mechanics.

(34) M. A. W. asks: 1. Will a steam boiler 4 feet long by 24 inches diameter, with a firebox 40 inches high, 16 inches wide, and 39 inches long, with 36 one inch flues, be large enough to run an engine with a cylinder, 5 x 6 inches, with 80 lbs. boiler pressure at 200 revolutions per minute? A. We think the boiler will answer. 2. Am I correct in estimating said engine at 2 horse power? A. Actual power will not exceed 1 horse. 3. Would the above engine run a traction engine with the driving wheels 5 feet in diameter, with gear wheels of 4 revolutions of the driver to one of the driven? What speed could I obtain on moderately good roads? A. With good machinery you might obtain a speed of 3 or 4 miles an hour. Your ideas as to reversing an engine contained no novel features.

(35) C. A. C. asks: 1. How can I varnish a colored mechanical drawing, so that the paper and drawing will not be marred by the operation? A. You must use varnish specially prepared for the purpose, which you can probably obtain from some one who mounts show cards. 2. What must be the circumferential velocity of an iron disk (not serrated) to sever a bar of cold iron? A. Between 1 and 2 miles a minute.

(36) L. M. C. says: I am nineteen years of age, and my ambition is to learn to be a competent practical locomotive engineer. What course would you advise me to pursue in order to obtain that end? A. You should try and get employment as a fireman on a locomotive. 1. Will high pressure steam produce a higher note on a steam whistle than low pressure steam on the same whistle? A. Generally, yes. 2. Will compressed air produce the same note on a steam whistle as steam does, the pressure being alike in both cases? A. The sound is often clearer when air is used. 3. What is the best way to stop foaming in a steam boiler? A. It is often due to the construction of the boiler, or the arrangement of the steam pipe. Sometimes it is caused by dirty water or too strong a fire. The causes will doubtless suggest the remedies.

(37) J. O. says, in reply to D. W.'s query as to the sudden welding of a mill spindle and its stop piece: I have had a similar experience in the uniting of hardened steel under excessive friction, due to the absence of lubricant. The foot of a steel pointed shaft, running at 180 revolutions a minute in a steel step and transmitting some 25 or 30 horse power, brought a water wheel to a sudden stop. The uniting was preceded by a pricking noise, similar to that made by an electric engine. Upon removing the shaft, a ridge of steel taken from the step was found on the foot of the shaft; and no cold chisel or file would make a mark on, and it could only be removed by a grindstone. Hardly any heat was to be felt. I believe the parts welded by wearing of parts to perfect surfaces, and then excessive friction completed the job.

(38) J. H. P. says, as to the welding of the spindle to the step plate: I think that the end of the spindle had worn a little hollow in the step plate, having the same curvature with itself. The pressure of the end of the spindle upon the bed plate had forced out the air and oil, and the two had come into actual contact, particle with particle, and were, hence, one piece.

(39) F. D. H. says: The statement of D. W. as to the welding of a mill spindle point to its step can be verified by three precisely similar cases, which have been brought to us for repairs. He is undoubtedly in error in regard to the point being well oiled. If that were the case, it would indeed be a remarkable occurrence; but when running dry, such things occasionally happen. In every instance that has come under our notice the weld was a perfect one, and defied all efforts to separate the pieces.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the result stated:

J. A. S.—It is iron pyrites or sulphide of iron. See p. 7, vol. 36.—W. R. S.—A quantitative analysis of fine clay, etc., would cost about \$15. About 2 lbs. of the material will be required. Send by express.—B. F. T.—It is indurated clay, containing markasite. See p. 7, vol. 35. It is of little value.—H. A. W.—Quantitative analyses cost from \$10 to \$30 each.

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:
On the Valuation of Sugar. By S. W.
On the Involute of the Circle. By L. D'A.
On a Tidal Motor. By A. S.
On City Travel. By T. B. McC.
On American Progress. By —.
On Fire Escapes. By G. L. B.

Also inquiries and answers from the following:
F. B. M.—G. S. B.—P. P. P.—L. S. B.—A. K. B.—C. P. R.—J. B. O.

HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fall to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Inquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of inquiries analogous to the following are sent: "Who makes dynamometers? Where can silkworms' eggs be obtained? Who makes brewers' machinery? Who sells tobacco-flavoring composition? Who sells coffee-roasting machinery?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

OFFICIAL.

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were

Granted in the Week Ending

April 3, 1877,

AND EACH BEARING THAT DATE.

[Those marked (r) are renewed patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired, and remit to Munn & Co., 57 Park Row, New York city.

Agitating and mixing, G. L. Witsell..... 189,293
Agricultural boiler, McAfee & True..... 189,051
Air guns, dart for, Spring & Robinson..... 189,070
Animal poke, R. E. Atteberry..... 189,109
Animal poke, B. D. Watson..... 189,138
Arm rest, P. B. Wagon..... 189,157
Ax helve shield, J. M. Larsh..... 189,139
Bag holder, J. Eberhard..... 189,202
Ball eye former, H. S. Reynolds..... 189,264
Bale tie, R. C. Pope..... 189,258
Bales, tightening bands on, M. Quinn..... 189,138
Barrels, trussing, P. Boomer..... 189,176
Baths, hot air and other, T. Keech..... 189,201
Bed bottom, spring, T. B. Jones..... 189,104
Bee hive, H. Wheaton..... 189,391
Beer kegs with soda, supplying, J. J. Schilling..... 189,399
Belts on pulleys, throwing, R. Reinhard..... 189,308
Binder, temporary, G. W. Emerson..... 189,238
Bird cage, A. E. Mook..... 189,251
Blind sash worker, E. C. Whipple..... 189,202
Bobbin, J. Mawson..... 189,243
Boiler bottom, C. R. Everson..... 189,366
Boiler furnace front, G. L. Allen..... 189,077
Bolt heading machine, A. F. Jackson..... 189,226
Boot heel stiffener, Moore & Rogers..... 189,196
Boot heel stiffener, N. J. Simonds..... 189,066
Boot stiffeners, making, N. J. Simonds..... 189,067

Boot shank support, G. W. Wells..... 189,161
Boots and shoes, lacing, N. Evans..... 189,027
Breach-loading firearm, I. M. Earle..... 189,026
Brick machine, C. Schickelknecht..... 189,270
Bridge, Avery & Bartholomew..... 189,170
Bridge pier, Avery & Bartholomew..... 189,171
Bridge pier, E. E. Coffey..... 189,030
Bridle, G. M. Strong..... 189,201
Broom machine, C. E. Lipe..... 189,243
Buckle, F. W. Schafer..... 189,208
Burial case, E. Metz..... 189,247
Burial case, A. Fischer..... 189,208
Butter cutter, Dugan & Moncrief..... 189,035
Butter dish, W. H. Fitch..... 189,030
Butter for packing, W. B. Bemis..... 189,073
Butter pail, J. Gilberds..... 189,212
Button fastening, S. A. Harellon..... 189,223
Cam motion, Houghtaling & Stillier..... 189,223
Cane and umbrella, M. M. Copp..... 189,094
Car axle lubricator, W. Palmer..... 189,138
Car coupling, J. Hayden..... 189,094
Car coupling, M. L. Mathias..... 189,099
Car heater, G. W. Dismann..... 189,096
Car pusher, H. La Tourette..... 189,113
Car starter, W. Jasper..... 189,227
Card board, ornamental, Adams & Bett..... 189,076
Carriage, portable engine, C. M. Milder..... 189,248
Carriage seat lock, Hayward & Hays..... 189,215
Cartridge, A. B. Smith..... 189,069
Cartridge shells, varnishing, Pratt & Reynolds..... 189,057
Cast iron into steel, converting, C. W. Siemens..... 189,273
Casting metals, C. & B. H. Dusenbury..... 189,090
Centrifugal dryer, etc., J. Buchanan, Jr..... 189,185
Chair and work table, G. L. Rich..... 189,141
Cigar wrapper, W. Broecker..... 189,182
Clevish, Connelly & Buckner..... 189,021
Clock lockwork, J. W. Williams (r)..... 7,594
Clothes drier, J. Kahn..... 189,229
Clutching device, H. Fuchs..... 189,219
Cocks and faucets, closing, Towle & Plass..... 189,153
Coffee mill, protector, etc., W. A. King..... 189,046
Coffee pot, R. L. Nelson..... 189,253
Coffee roaster, N. Metz..... 189,124
Coin detector, counterfeiter, J. A. Thompson..... 189,284
Coin tray, A. A. Hyde..... 189,101
Collar, standing, J. K. P. Pine..... 189,134
Cooling liquids, A. D. Puffer..... 189,137
Cork, or bung for cans, etc., T. Tully..... 189,073
Corn ball presser, C. E. Vankeuren..... 189,074
Corn drill, D. Kerschner..... 189,044
Corn planter, D. C. Bacon..... 189,173
Corn planter, H. Wagoner..... 189,156
Corn planter, hand, W. E. Seelye..... 189,142
Corn sheller, H. Neubert..... 189,150
Cotton press, C. J. Beasley..... 189,177
Cotton press, G. C. McKee..... 189,121
Cotton press, J. Templeton..... 189,148
Cotton seed planter, R. Ball..... 189,174
Crucibles, making plumbago, W. Smith (r)..... 7,593
Culinary vessel, H. C. Milligan..... 189,250
Cultivator, fallow, J. Richardson..... 189,266
Dental plugger, K. L. Mills..... 189,249
Die for sucker rod joints, G. Douglass..... 189,200
Door handle and catch, W. C. Folant..... 189,028
Dynamo-electric machine, D. F. J. Loutin..... 189,116
Eave trough fastener, A. J. Gilbert..... 189,094
Egg carrier, W. J. H. Kappe..... 189,230
Electro-magnetic regulator, R. A. Hayes..... 189,098
Engine, high and low pressure, T. L. Jones (r)..... 7,585
Envelope, H. C. Carter..... 189,159
Eyeglass, I. H. Johannes..... 189,103
Feathering paddle wheel, H. Williams..... 189,164
Feed water heater, B. Eynon..... 189,206
Felly, W. A. Wharton..... 189,102
Fence post, J. R. Peffley..... 189,256
Fence post tip, D. C. Morris..... 189,252
Fence wire barbed, O. O. Kittleson..... 189,047
Fence wire, barbed, J. McNeill..... 189,122
Flat iron heater, S. B. Dinsmore..... 189,198
Flux, composition, C. F. Secor..... 189,271
Friction clutch, M. Rumely..... 189,062
Furnace grate, B. Hershey..... 189,218
Furnaces, supplying air to, W. Halsted..... 189,097
Gas making, illuminating, J. Absterdam..... 189,106
Gas, making illuminating, J. Rigby (r)..... 7,590
Gas retorts, raking, T. F. Rowland (r)..... 7,592
Gas retorts, charging, T. F. Rowland (r)..... 7,591
Gear wheels, making, J. Comly (r)..... 7,584
Gimlets and twist drills, J. C. Richardson..... 189,265
Ginger snaps, making, Bell & Hills..... 189,178
Glass pipe coupling, H. P. Humphrey..... 189,041
Glass shades, etc., making, J. Bourne..... 189,180
Governor, J. W. Collet..... 189,130
Governor, stop motion, L. Skinner..... 189,098
Grain binder, Hodges & Blum..... 189,221
Grain binder, C. B. Withington..... 189,164
Grain elevator, floating, C. W. Mills (r)..... 7,588
Grain separator, N. Kibler..... 189,045
Grain separator, E. F. Osborne..... 189,255
Grate bar, E. Stroth..... 189,281
Grinding machine, G. A. Knowlton..... 189,238
Hammers, die for, Kip & Rieckel..... 189,232
Harrow, E. T. Bousfield..... 189,181
Harvester, O. N. Skarnas..... 189,145
Harvester reel, E. L. Phipps..... 189,257
Hay elevator, J. & P. Lux..... 189,241
Hay elevator and conveyor, J. R. Moran..... 189,053
Hay for fuel, winding, E. Harding..... 189,097
Hinge for boxes, etc., A. F. Gerald..... 189,211
Hoe, O. H. Hicks..... 189,220
Hoisting machine, D. H. Merritt..... 189,128
Horse blanket, J. C. Ayres..... 189,172
Horse collar, H. W. & C. F. Whitney..... 189,163
Horse hay fork, P. Grant..... 189,095
Horsehoe, C. W. Atkinson..... 189,011
Horsehoe nail plates, beveling, J. M. Laughlin..... 189,111
Horsehoe nails making, J. M. Laughlin..... 189,104
Horsehoe nails, making, G. L. Hall..... 189,031
Hose bridge, J. Taylor..... 189,072
Hose coupling, A. E. Rich..... 189,069
Hydrocarbon furnace, B. Hershey..... 189,217
Ice tool, J. Crawford..... 189,196
Injector, J. Proeger..... 189,259
Inkstands, filling and emptying, I. M. Fisher..... 189,209
Insulated wire, H. Redding..... 189,302
Ironing table, G. W. Hook..... 189,222
Ironing table, T. Libby..... 189,239
Knife scourer, P. Hannersperger..... 189,214
Knife scouring pan, Cassel & Zint..... 189,081
Knob latch, W. A. Barlow..... 189,013
Knobs, to shanks, attaching, W. A. Barlow..... 189,012
Knobs to spindles, attaching, W. D. May..... 189,244
Labeling machine, Knoch & Salomon..... 189,234
Lamp, W. A. Butler..... 189,186
Lamp, S. A. Newton..... 189,131
Lamp bracket, Sherwin & Hoople..... 189,064
Lamps, center, Sherwin & Hoople..... 189,068
Lamp for hydrocarbon oils, etc., D. McCarty..... 189,246
Lamp, night, H. W. Huntington..... 189,100
Lamp or chandelier, oil, J. F. Lauth..... 189,119
Lamp screen holder, J. E. Hubbell..... 189,224
Lamp shade holder, H. L. Ives..... 189,102
Lard cooler, W. P. Harvey..... 189,032

DESIGNS PATENTED.

8,978.—CORSET.—M. Adler, New Haven, Conn.
8,974 to 8,976.—CARPETS.—A. Baye, London, England.
8,977.—DISHES.—E. Boote, New York city.
8,978.—TYPES.—J. M. Conner, Greenville, N. J.
8,979.—STOVES.—B. A. Culler et al, Peoria, Ill.
8,980.—CARPETS.—E. Daniel, Paris, France.
8,981.—MOTTO.—J. W. Fleischmann, Williamsburg, N. Y.
8,982.—HINGS.—F. T. Fracker et al, New Britain, Conn.
8,983 to 8,986.—NECKLACE.—G. F. Glendon, Newark, N. J.
8,987.—CHAIRS, etc.—H. F. Goodwin, Sheboygan, Wis.
8,988.—CHAIN FRAME.—A. G. Hofstatter, New York city.
8,989.—OIL CLOTHS.—J. Hutchinson, Newark, N. J.
8,990.—STOVES.—O. B. Keesley, Spring City, Pa.
8,991.—PIPE.—J. F. Hart, Jr., Camden, N. J.

[A copy of any of the above patents may be had by remitting one dollar to MUNN & CO., 57 Park Row, New York city.]

on receipt of price.

Advertisements.

Inside Page, each insertion --- 75 cents a line.
Back Page, each insertion --- \$1.00 a line.

Engravings may be made at the same rate per line, by measurement, as the letter press. Advertisements must be received at publication office as early as Friday morning to appear in next issue.

GUARDIOLA'S COFFEE & SUGAR MACHINERY

Coffee, Malt, Corn, Cocoa, and Grain-Drying Machine. Coffee-Hulling and Polishing Machine. Coffee-Washing Machine. Helix Sugar Evaporator.

Messrs. C. ADOLPHE LOW & CO., 42 Cedar Street, New York, are Mr. Guardiola's Agents, and they will give prompt attention to all orders for any of the above machines.

Best Tempered Cast Steel.
Retail Price, 9 Cents per lb.
WARRANTED. Send for Circular.
Fisher & Norris, Trenton, N. J.

MACHINISTS' TOOLS.

NEW AND IMPROVED PATTERNS.
Send for new illustrated catalogue.

Lathes, Planers, Drills, &c.
NEW HAVEN MANUFACTURING CO.,
New Haven, Conn.

BAKER'S Rotary Pressure Blower



Warranted superior to any other.
WILBRAHAM BROS.
No. 2318 Frankford Avenue, Philadelphia.



[ESTABLISHED 1846.]

Munn & Co's Patent Offices.

The Oldest Agency for soliciting Patents in the United States.

THIRTY YEARS' EXPERIENCE.

MORE PATENTS have been secured through this agency, at home and abroad, than through any other in the world.

They employ as their assistants a corps of the most experienced men as examiners, specification writers, and draughtsmen, that can be found, many of whom have been selected from the ranks of the Patent Office.

SIXTY THOUSAND inventors have availed themselves of Munn & Co.'s services in examining their inventions and procuring their patents.

Munn & Co., in connection with the publication of the SCIENTIFIC AMERICAN, continue to examine inventions, confer with inventors, prepare drawings, specifications, and assignments, attend to filing applications in the Patent Office, paying the Government fees, and watch each case, step by step, while pending before the examiner. This is done through their branch office, corner F and 7th Sts., Washington. They also prepare and file caveats, procure design patents, trade marks, and releases, attend to rejected cases (prepared by the inventor or other attorneys), procure copyrights, attend to interference cases, give written opinions on matters of infringement, furnish copies of patents, and, in fact, attend to every branch of patent business, both in this and in foreign countries.

A special notice is made in the SCIENTIFIC AMERICAN of all inventions patented through this agency, with the name and residence of the patentee. Patents are often sold, in part or whole, to persons attracted to the invention by such notice.

Patents obtained in Canada, England, France, Belgium, Germany, Russia, Prussia, Spain, Portugal, the British Colonies, and all other countries where patents are granted, at prices greatly reduced from former rates. Send for pamphlet pertaining specially to foreign patents, which states the cost, time granted, and the requirements for each country.

Copies of Patents.

Persons desiring any patent issued from 1836 to November 26, 1867, can be supplied with official copies at reasonable cost, the price depending upon the extent of drawings and length of specifications.

Any patent issued since November 27, 1867, at which time the Patent Office commenced printing the drawings and specifications, may be had by remitting to this office \$1.

A copy of the claims of any patent issued since 1836 will be furnished for \$1.

When ordering copies, please to remit for the same as above, and state name of patentee, title of invention, and date of patent.

A pamphlet, containing full directions for obtaining United States patents, sent free. A handsomely bound Reference Book, gilt edges, contains 160 pages and many engravings and tables important to every patentee and mechanic, and is a useful handbook of reference for everybody. Price 25 cents, mailed free.

Address

MUNN & CO.,

Publishers SCIENTIFIC AMERICAN,

37 Park Row, N. Y.

BRANCH OFFICE—Corner of F and 7th Streets, Washington, D. C.

NOYE'S MILL FURNISHING WORKS

are the largest in the United States. They make Burr Millstones, Portable Mills, Shot Machines, Packers, Mill Picks, Water Wheels, Pulleys and Gearing, specially adapted to flour mills. Send for Catalogue.

J. T. NOYE & SON, Buffalo, N. Y.

ESTABLISHED 1844.

JOSEPH C. TODD,

(Formerly of Todd & Raftery), ENGINEER and MACHINIST. Flax, Hemp, Jute, Rope, Oakum, and Bagging Machinery, Steam Engines, Boilers, etc. Also Agent for the celebrated and improved Rawson & Rittinger Hoisting Engine, I will furnish specifications and estimates for all kinds of machinery. Send for descriptive circular and price. Address

J. C. TODD,

10 Barclay St., New York, or Paterson, N. J.

JOS. G. ROGERS & CO., MADISON, IND., wish to place a consignment of their Tannate of Soda BOILER SCALE PREVENTIVE in all important towns in the United States. To be sold on commission. Applications solicited. Send for book on Boiler Incrustation.

NON-COMBUSTIBLE STEAM BOILER AND PIPE

COVERING

WITH "AIR SPACE" IMPROVEMENT.
Saves 10 to 20 per cent. CHALMERS SPENCE CO.,
Foot E. 9th St., N. Y.; 132 N. 2d St., St. Louis, Mo.

HARTFORD

STEAM BOILER

Inspection & Insurance

COMPANY.

W. B. FRANKLIN, V. PRES. J. M. ALLEN, PRES.
I. B. PIERCE, Sec'y.

\$5 to \$20 per day at home. Samples worth \$5 free. STINSON & CO., Portland, Me.

STEAM PUMPS

Wright's Pat. Bucket Plungers are the best. VALLEY MACHINE CO., Easthampton, Mass.

PERFECT

NEWSPAPER FILE

The Koch Patent File, for preserving newspapers, magazines, and pamphlets, has been recently improved and price reduced. Subscribers to the SCIENTIFIC AMERICAN and SCIENTIFIC AMERICAN SUPPLEMENT can be supplied for the low price of \$1.50 by mail, or \$1.25 at the office of this paper. Heavy board sides; inscription "SCIENTIFIC AMERICAN," in gilt. Necessary for every one who wishes to preserve the paper.

Address

MUNN & CO.,
Publishers SCIENTIFIC AMERICAN.

MACHINERY OF IMPROVED STYLES FOR making SHINGLES, HEADING AND STAVES; also GAUGE LATHES for TURNING HANDLES. Sole makers of Law's Pat. Shingle and Heading Saws. Machine. Address

TREVOR & CO., Lockport, N. Y.

THE BEST

AND MOST ECONOMICAL

Boiler Feeder

IS

FRIEDMANN'S INJECTOR,

MANUFACTURED BY

NATHAN & DREYFUS, New York.

108 Liberty St.

Send for Circular.

Boulton's Patent

Reverse Motion

Paneling, Variety

Moulding, and

Dovetailing

Machine.

Cuts Panels of any design or style of mould in the solid wood with neatness and dispatch. Is a first class Shaper, Edge and Scrool Moulder. Does general Dovetailing with thick or thin stuff.

Simple, Durable and Efficient.

Send for Pamphlet and Sample of work.

Improved Solid Steel Cutters for all kinds of Variety Moulders made to order, and warranted by the

H. C. MACHINERY CO.,
BATTLE CREEK, MICH.

P. BLAISDELL & CO.,

Worcester, Mass.,

Manufacturers of the Blaisdell Patent Upright Drills and other first-class Machinists' Tools.

S. GUITERMAN, EXPORT AND COMMISSION Merchant, No. 44 Lawrence Lane, Chesham, London. New York office, Guiterman Brothers, 64 Broadway. Best of attention to introduce Merchandise, Patents, etc., in any part of Europe.

Local and Traveling Agents Wanted in every State and Territory in the Union, to sell Mechanical Goods. Liberal commission offered. Prompt replies desired, and full details. Address "MORGAN," Box 264, N. Y.

Blake's Patent Stone & Ore Crusher.

NEW PATENT, with important improvements, and abundant strength. This is the only machine used by the principal MUNICIPAL, RAILROAD and MINING CORPORATIONS and CONTRACTORS in the United States and foreign countries, for breaking hard and brittle substances to ANY SIZE. Send for circular. Address,

BLAKE CRUSHER CO., New Haven, Ct.

UPRIGHT DRILL PRESSES.

H. BICKFORD, Cincinnati, O.

Niagara

Steam Pump Works.

ESTABLISHED 1835.

CHARLES B. HARDICK,
No. 23 Adams Street,
BROOKLYN, N. Y.

KNOWLES'

STEAM PUMP WORKS,

92 & 94 Liberty St., New York.

Great reduction in prices. Send for catalogue. The "Knowles" has always been the best steam pump made.

ROCK DRILLING MACHINES

AND

AIR COMPRESSORS.

MANUFACTURED BY BURLEIGH ROCK DRILL CO., FITCHBURG MASS.

SEND FOR PAMPHLET.

Type and Printing Materials

FOR SALE.

The following Fonts of Type, in good condition, having been but little used:

Brevier, on Long Primer Body, about 550 lbs.

Brevier, 100 lbs.

Nonpareil, on Brevier Body, 300 lbs.

Agate, 250 lbs.

Sixteen Cases Job Type, in Cabinet.

All the above are Copper-faced.

Lends, Brass Rules, etc.

Cases, 44 pairs.

Column Galleys, brass bottomed, 6.

Chases, wrought iron, 2 pairs, 36x24 inches.

Composing Frames, 4.

Racks, 2.

Imposing Stones, one 75x30 inches, one 72x30, both on stands with drawers.

Roller Press.

The above were used on the SCIENTIFIC AMERICAN, and are in clean and perfect condition. The room in which the above is deposited is wanted for other purposes on the first of May, and the lot will be sold very cheap. Apply at the office SCIENTIFIC AMERICAN, 37 Park Row, N. Y., for further particulars.

EAGLE FOOT LATHES,

Improvement in style. Reduction in prices April 20th. Small Engine Lathes, Slide Rests, Tools, etc. Also Scroll and Circular Saw Attachments, Hand Planers, etc. Send for Catalogue of outfits for Amateurs or Artisans.

WM. L. CHASE & CO.,
95 & 97 Liberty St., New York.

FOR SALE, TO CLOSE THE CONCERN.

Entire contents of Machine Shop, entrance 530 Water St., New York, consisting of 30 h. Steam Boiler, now in good running order, 12 h. p. Steam Engine, Cameron Steam Pump, Planing Machine, Engine Lathes, Milling Machines, Screw Cutters, Ordinary Lathes, Shears, Presses, Small Blower, Forge, Vises, Variety of Small Tools, Shafting, Pulleys, Belting, Benches, Patterns, etc.

Will be sold in lots to suit purchasers, at very low prices. Apply immediately to E. D. BARLOW, Assignee, as above. Lease of premises—50x20 ft.—for sale.

\$3 PRINTING PRESS!

Prints cards, envelopes, etc., equal to any press. Larger sizes for large work. Do your own printing and advertising and save money. Excellent spare hour amusement for old or young. Or it can be made money making business anywhere. Send 3c. stamps for large catalogue to

KELSEY & CO., Manufacturers,
Meriden, Conn.

PUNCHING

Drop Hammers and Dies, for working Metals, &c. THE STILES & PARKER PRESS CO., Middletown, Conn.

1872, 1873, 1874, 1875, 1876,

SCIENCE RECORD.

A few copies of these splendid books, copiously illustrated, are offered at the following very low prices. Persons desiring a condensed history of the most interesting Facts and Discoveries in the Arts, Sciences, and Inventions, for the years from 1872 to 1876, will find them recorded in the five volumes of the SCIENCE RECORD, now offered at half the original price.

Every Department of Science treated in these volumes, and the important discoveries of the several years are not only faithfully described, but many of the subjects are illustrated with finely executed engravings, prepared expressly for these Annuals.

Among the subjects, the following are the most noteworthy, exhibiting in a condensed form a general account of the Progress of the World:

CHEMISTRY AND METALLURGY, MECHANICS AND ENGINEERING, ELECTRICITY, LIGHT, HEAT, SOUND, TECHNOLOGY, THE USEFUL ARTS, BOTANY AND AGRICULTURE, AGRICULTURE, RURAL AND HOUSEHOLD ECONOMY, MATERIA MEDICA, THERAPEUTICS, HYGIENE, NATURAL HISTORY AND ZOOLOGY, METEOROLOGY, TERRESTRIAL PHYSICS, GEOGRAPHY, GEOLOGY AND MINERALOGY, ASTRONOMY, BIOGRAPHY AND NEOLOGY.

Each yearly volume contains about 600 octavo pages, including a large number of handsome engravings. They are bound in substantial and handsome bindings, and will be mailed on receipt of \$1.25 each, or \$5 for the set of five volumes.

They were published and heretofore sold at \$2.50 each, or \$10 for the set.

State, in remitting for a single volume, which year, from 1872 to 1876, is desired, remitting the date of the volume covers the events and discoveries of the previous year. Sent by mail on receipt of price. Address

MUNN & CO., PUBLISHERS,
37 Park Row, New York city.

PATENT

COLD ROLLED

SHAFTING.

The fact that this shafting has 75 per cent. greater strength, a finer finish, and is truer to gauge, than any other in use, renders it undoubtedly the most economical. We are also the sole manufacturers of the CELEBRATED COLLINS PAT. COUPLING, and furnish Pulleys, Hangers, etc., of the most approved styles. Price list mailed on application to

JONES & LAUGHLIN,
Try Street, 3d and 4th Avenues, Pittsburgh, Pa.
208 Canal Street, Chicago, Ill., and Milwaukee, Wis.

Stocks of this shafting in store and for sale by FULMER, DANA, & FITZ, Boston, Mass.

GEO. PLACE & CO., 121 Chambers St., N. Y.

WOOD & LIGHT

Machine Co.

WORCESTER, MASS.

Manufacture all kinds of Iron-Working Machinery, including many novelties. Shafting, Pulleys, &c. Send for Circulars.



THE TANITE CO.,

STROUDSBURG, PA.

EMERY WHEELS AND GRINDERS.

GEO. PLACE, 121 Chambers St., New York Agent.

BUY YOUR BOILER AND PIPE

COVERING

direct from the Manufacturers.

ASBESTOS FELTING CO.,
Front St., near Gouverneur, N. Y.

Pyrometers,

For showing heat of Ovens, Hot Blast Pipes, Boiler Flues, Super-Heated Steam, Oil Stills, &c.

HENRY W. BULKLEY, Sole Manufacturer,
149 Broadway, New York.

A. S. CAMERON'S

PATENT

"SPECIAL" Steam Pump

Is the Standard of Excellence at home and abroad.

REDUCED PRICE LIST.

Number.	PRICE.	Steam Cyl.	Pump Cyl.	Stroke.
0	\$ 50	3 1/2 in.	2 in.	4
1	75	4 1/2 in.	3 in.	6
2	100	5 1/2 in.	4 in.	8
3	150	6 1/2 in.	5 in.	10
4	200	7 1/2 in.	6 in.	12
5	275	8 1/2 in.	7 in.	14
6	325	9 1/2 in.	8 in.	16
7	400	10 1/2 in.	9 in.	18
8	425	11 1/2 in.	10 in.	20
9	450	12 1/2 in.	11 in.	22
10	550	14 1/2 in.	12 in.	24
11	700	16 1/2 in.	14 in.	28
12	850	18 1/2 in.	16 in.	32

Illustrated Catalogue sent free, on application to the Inventor and Sole Manufacturer in the United States,

A. S. CAMERON,

Works, Foot of East 23d St.

NEW YORK CITY.

The HOADLEY

PORTABLE STEAM ENGINE,

WITH AUTOMATIC CUT-OFF REGULATOR

AND BALANCED VALVE.

THE BEST & MOST ECONOMICAL ENGINE MADE

SEND FOR CIRCULAR.

The J.C. HOADLEY CO. LAWRENCE, MASS.

STATE WHERE YOU SAW THIS.

The New \$20 Microscope

is fully equal to any that could have been bought three years ago for \$50. Send for descriptive circular.

For the best book of practical instruction get "How to Use the Microscope," by John Philm. 75 cts. by mail.

INDUSTRIAL PUBLICATION CO., 176 Broadway, N. Y.

FOOT POWER TENONING MACHINES FOR SALE

By S. C. HILLS, 78 Chambers St., New York.

"IN ALL THINGS, BUT PROVERBIAL IN MECHANISM, THE SUPREME EXCELLENCE IS SIMPLICITY."—Jas. Watt.

The Old Reliable Heald & Sisco Pump

Carries off the honors at the CENTENNIAL. The award of the Judges is based on its "SIMPLICITY, compactness, and perfection of WORKMANSHIP."

No higher praise could be given, but no award whatever was necessary to strengthen the confidence of thousands already using them. Whenever subjected to severe practical tests, they have always proved their superiority over other centrifugal pumps, and always will, as it is absolutely impossible to devise a pump which can excel it for simplicity, tremendous capacity, and cheapness. Capacity of Pumps from one hundred gallons to thirty-five thousand gallons per minute. For Paper Makers, Tanners, Contractors; for irrigation, or for any purpose where a large quantity of water or other fluid is to be raised, the Heald & Sisco Pump stands without a rival. More than three hundred paper makers use them. More than three hundred tanners use them. They are used in every State of the Union, and in nearly every country in the world. Pumps alone, and Pumps and Engines combined, adapted to nearly every kind of work, on hand and built at short notice.

First premiums awarded at New Orleans in 1871, in Cincinnati in 1872, and an award for Special Merit at the American Institute in 1876. Send for illustrated pamphlet of 75 pages, with 15 pages of certificates and references. Address

HEALD, SISCO & CO., Baldwinville, N. Y.

YALE VERTICAL MILL.

SCIENTIFIC AMERICAN

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. XXXVI. No. 20.
[NEW SERIES.]

NEW YORK, MAY 19, 1877.

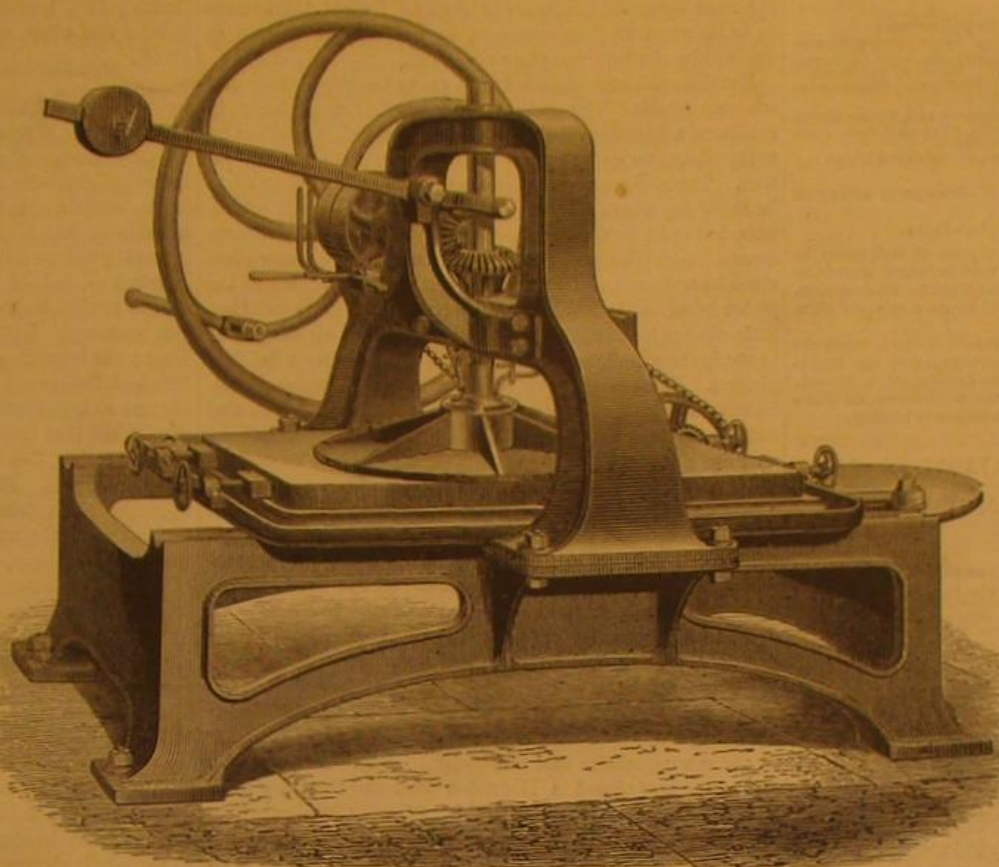
[\$3.20 per Annum.
[POSTAGE PREPAID.]

NEW LITHOGRAPHIC STONE-DRESSING MACHINE.

Lithographic stone is an argillaceous limestone, of a color varying from light buff to a pearl gray. It is quarried in mass, and is split or sawn into slabs of two or three inches in thickness and of any required size. To prepare the stone for use, it is ground to a perfectly uniform face; and then, if the drawing is to be in crayon, a grained surface is produced by rubbing two stones together, fine or coarse sand and water being introduced, according to the nature of the face desired. If the drawing is to be in ink, the surface is polished; but if it is to be in crayon and quite coarse, as is the case with the elegant theatrical show-bills now made by this process, a comparatively rough face is needed. The labor of polishing is done by hand, and it is quite severe, necessitating in most establishments a workman who devotes his time to that alone. A machine has recently been devised for this purpose by MM. Perron and Dehaitre, the annexed engraving of which we extract from the *Revue Industrielle*. It has been found especially useful in working upon large stones, and is said to be capable of performing the labor of six men, and to need but one person to rotate the crank. It also substitutes a uniform pressure in lieu of the variable one exerted by the hand, and thus allows of the production of stones having a much truer face. The construction is exceedingly simple, and requires but little description. The crank wheel actuates bevel gearing, rotating a vertical shaft which carries the grinding disk. The shaft is weighted as shown, and the stone is adjusted on the carriage of the machine by clamps. The carriage moves in ways on the bed, and is caused to travel gradually from end to end of the latter by a simple feed motion actuated by a chain belt from the crank arbor. Pulleys are provided for belting for the application of steam power, and a small pipe leads the water supply from any suitable reservoir.

PORTABLE STEAM ENGINE.

The war in Europe, which has just begun, cannot fail to create a greatly increased demand for American breadstuffs; and as the prospects for the grain crop, as reported from all sections of the country, were never better, our farmers will doubtless require more steam engines this year than ever before. The engine herewith illustrated is well adapted to farm and plantation purposes. It differs from others of its class in the arrangement of the engine on the boiler. The steam cylinder has a broad base, which is fastened to the smoke box by bolts, so as to prevent leakage of steam, however great the strain. Connecting the cylinder with the saddle which supports the crank shaft are two wrought iron bars, constituting the framing, which receive the working stress of the engine. The free expansion of the boiler under all pressures is provided for by the arrangement



PERRON AND DEHAITRE'S STONE DRESSER.

of the saddle, which is not fastened to the boiler. The condensing feedwater heater is placed directly under the boiler, and the feed pump is located below the water line in tank and heater. A single eccentric drives the pump and steam valve. The governor is driven directly from the crank

high. This economy has been accomplished without increasing the total weight of the engine.

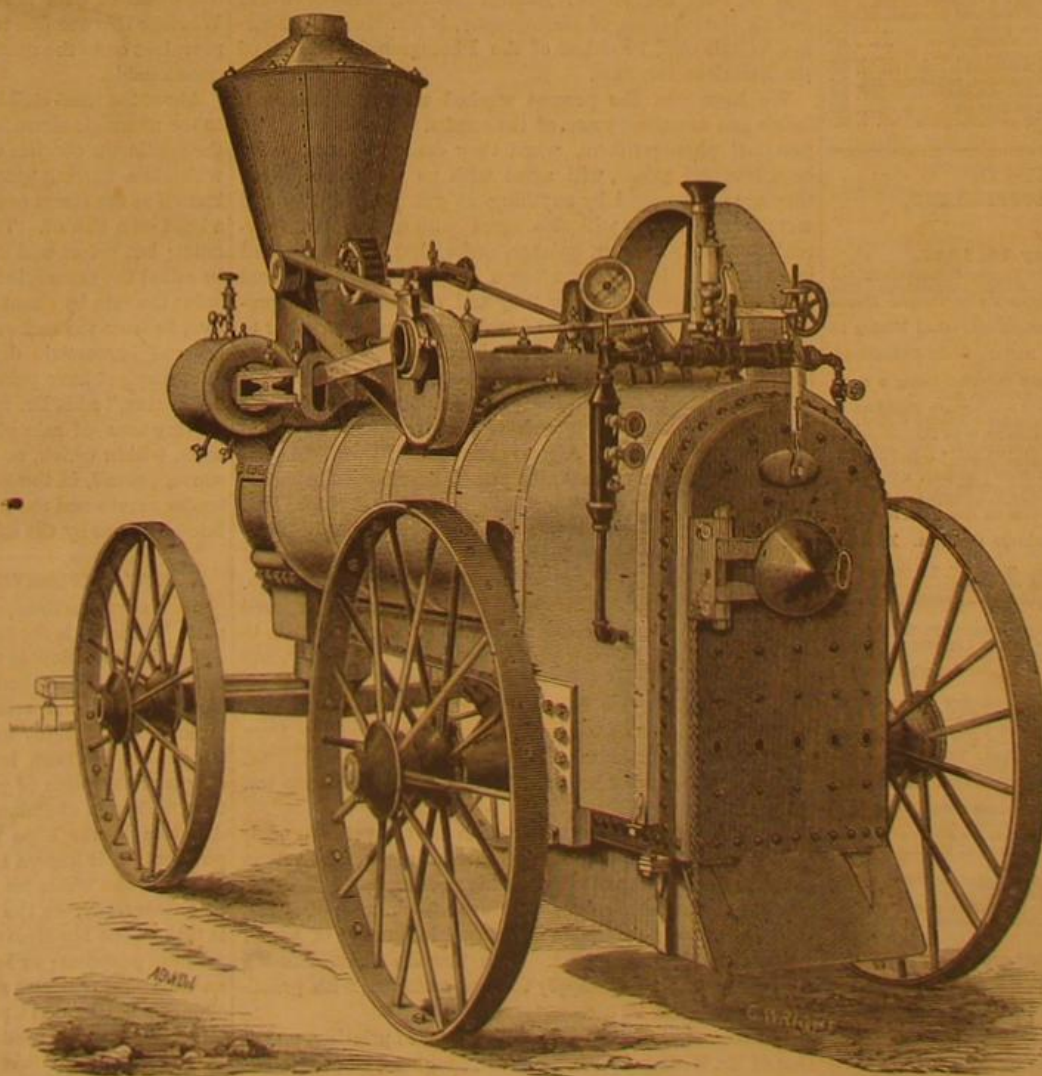
As far back as the Vienna Exposition, Professor R. H. Thurston, then acting as Commissioner for this country, stated in his report on portable steam engines that, although the English builders were far in advance of all others exhibiting, the Mills engine rivalled the best of them.

The engine is made in three different styles, namely, the mounted farm engine as shown in the engraving, the self-moving or thrasher's locomotive, and the self-contained or semi-portable for stationary purposes. For prices and other particulars, address the Fishkill Landing Machine Company, Fishkill-on-the-Hudson, N. Y., or Thomas J. Fales, 18 Park Place, New York, agent for foreign countries.

Helpful Sympathy.

A newspaper editor in the mining regions of Pennsylvania philosophically observes: "When a man gets both of his legs mashed, rendering him unable to work for three months, there's nothing that cheers him up so much, and so effectually keeps the wolf from the door, as for his fellow-workmen to pass a series of resolutions praying for his speedy recovery, and ordering an engrossed copy of the same to be presented to his family."

ARTIFICIAL coral can be made of 4 parts yellow resin and 1 part vermilion, melted very fine.



MILLS' PORTABLE STEAM ENGINE.

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors

PUBLISHED WEEKLY AT
NO. 37 PARK ROW, NEW YORK.

O. D. MUNN.

A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year, postage included..... \$3 20
 One copy, six months, postage included..... 1 60
 Clubs.—One extra copy of THE SCIENTIFIC AMERICAN will be supplied gratis for every club of five subscribers at \$3.20 each; additional copies at same proportionate rate. Postage prepaid.

The Scientific American Supplement

is a distinct paper from THE SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly; every number contains 16 octavo pages, with handsome cover uniform in size with THE SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, \$5.00 a year, postage paid, to subscribers. Single copies 10 cents. Sold by all news dealers throughout the country.

Combined Rates.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, postage free, on receipt of seven dollars. Both papers to one address or different addresses, as desired.
 The safest way to remit is by draft, postal order, or registered letter.
 Address MUNN & CO., 37 Park Row, N. Y.

Subscriptions received and single copies of either paper sold by all the news agents.

Publishers' Notice to Mail Subscribers.

Mail subscribers will observe on the printed address of each paper the time for which they have prepaid. Before the time indicated expires, to insure a continuity of numbers, subscribers should remit for another year. For the convenience of the mail clerks, they will please also state when their subscriptions expire.

New subscriptions will be entered from the time the order is received; but the back numbers of either the SCIENTIFIC AMERICAN or the SCIENTIFIC AMERICAN SUPPLEMENT will be sent from January when desired. In this case, the subscription will date from the commencement of the volume, and the latter will be complete for preservation or binding.

VOL. XXXVI., No. 20. [NEW SERIES.] Thirty-second Year.

NEW YORK, SATURDAY, MAY 19, 1877.

Contents.

(Illustrated articles are marked with an asterisk.)

Air compressor, high speed*.....	319	Magic lantern, light for (4).....	315
American inventor, the.....	327	Man, marvels of.....	319
Annotto, extract of (27).....	315	Memory, culture of the.....	312
Answers to correspondents.....	315	Mill spindles, bearings for (6).....	315
Arsenite of copper (28).....	315	Mirrors, silver from (28).....	315
Balloons, hot air (31).....	315	Moles, silver from (28).....	315
Basswood, bending (19).....	315	Mosquitoes, to prevent (9).....	315
Battery, a simple (44).....	315	Motors, small (2).....	315
Boiler difficulty, a (18).....	315	Navy, the Russian and Turkish.....	304
Boiler for small engine (38).....	315	Neuralgic storm belts.....	308
Boilers, cast and wrought iron (38).....	315	New books and publications.....	307
Boilers, loss in (11).....	315	Papyrus or paper road, the*.....	307
Boiling water in vacuo (31).....	315	Patent decisions, recent.....	313
Business and personal.....	315	Patents, American and foreign.....	313
Capillary experiments*.....	306	Patent, official list of.....	316
Carbons for batteries (42).....	316	Phosphorus on gun sights (17).....	315
Cars, heating with steam (16).....	315	Photographic improvements.....	314
Coral, artificial.....	315	Phthalic acid.....	315
Correspondence, Washington.....	306	Pipe tongs, wrench, etc.....	310
Earth's retardation, the (23).....	315	Post office, N. Y., accident in.....	308
Eggs, preserving (12).....	315	Potato bug, new remedy for.....	308
Eggshells, hardening (32).....	315	Pump bucket, rubber*.....	310
Electric annunciators (34).....	315	Rosin, purifying (31).....	315
Engines, compound.....	315	Saws, thin (10).....	315
Engines, high pressure (17).....	315	Sea water on land, action of.....	307
Explosive, a new.....	304	Secretary bird, the.....	311
Fireproof walls.....	307	Setting of soil (10).....	315
Fish, fresh and salt water.....	305	Siphons in mines (25).....	315
Fish scaler, improved*.....	306	Spindles, welding (36, 40, 41).....	316
Fishing extraordinary.....	313	Stains, ink (35).....	315
Fog horns, blowing (35).....	315	Steam cars vs. horses (7).....	315
Galvanic shocks from relays (43).....	316	Steam engine, portable*.....	308
Gardening all the year round.....	307	Sunlight, the synthesis of*.....	303
Gilding book covers, etc. (39).....	315	Sympathy, helpful.....	303
Gravity and centrifugal force (15).....	315	Tanning materials, scarcity of.....	311
Great Eastern, the, a meat ship.....	307	Tantalite (37).....	316
Heat and pressure of steam (8).....	315	Telegraphs, underground.....	311
Heating pipes, steam (30).....	315	Telescope eyepieces (7).....	315
Horse, strength of a (17).....	315	Tin and copper, separating (29).....	315
Horses' feet, care of.....	312	Umbrellas, past and present.....	312
How to do it and how not to do it*.....	309	Velocipede, water (30).....	315
Ink, indelible, with oil (33).....	315	Vermilion, removing (2).....	315
Ink, stencil (27).....	315	Violins, grooves on, etc. (39).....	316
Kingfisher, a remarkable.....	311	Wages in Scotland.....	308
Laughing jackass, the.....	311	Walnut furniture, polishing (32).....	315
Lead pipes nearly harmless (1).....	315	Water boiled in a sieve.....	306
Lithographic stones, dressing*.....	303	Weighing instrument, new.....	305
Live long, how to.....	305	Woodwork, cleansing the.....	311
Lost his ambition.....	305		

TABLE OF CONTENTS OF
THE SCIENTIFIC AMERICAN SUPPLEMENT,
No. 72,

For the Week ending May 19, 1877.

I. ENGINEERING AND MECHANICS.—On the Minute Measurements of Modern Science. By ALFRED M. MAYER. With 5 illustrations. The Vernier Scale; how to make and read it. Mayer's new Vernier Microscope. Pipes for Gas and other purposes, 5 illustrations. Coal Mining at Steubenville, Ohio. The Babcock and Wilcox Sectional Steam Boiler. With dimensions, construction, and 3 engravings. Steam Boiler Explosions during the past six months; being a catalogue and brief description of each accident, locality, etc. The New United States Iron Landing Pier: Delaware Breakwater Harbor; built on Iron Screw Piles. Designed by Lieut. Col. J. D. KURTZ, U. S. Corps of Engineers. A full History, with Map, Description, Details, and Scale Drawing. By A. STEINLE, C. E., Assistant Engineer of the works. A valuable and important paper. Two pages of engravings.—Recent Improvements in Steel Ship Building, exhibiting the economy and advantages of this important method. Dynamograph Railway Experiments.—Preservation of Wooden Railway Ties; showing the life of various preserved Ties on European railways, and the different modes of impregnation. New Method of Cooling Cannon and other large Castings. By J. S. ROBINSON.	
II. TECHNOLOGY.—On the Dyeing of Leather. By M. W. EYNER. Presenting a number of valuable recipes and directions.—Transfer of Negative Films to paper.—The Cod Fisheries of Norway, with an account of the production of Cod Liver Oil.	
III. ELECTRICITY, LIGHT, HEAT, ETC.—Improvement in Generating Electric Currents. By ALEXANDER GRAHAM BELL; 4 figures. Production of the Lime Light without Oxygen Gas. Curious Results in the Production of Heat.—A Boiler with an Open Bottom.	
IV. CHEMISTRY, METALLURGY, ETC.—The Chemistry of Gas Manufacture, by A. VERNON HARCOURT, F. R. S., one of the Metropolitan Gas Refusers. An interesting and valuable paper; showing the Origin of Coal. How Coal was Formed. Greatest Depth for Coal. Changes in Coal by Heat. Oil from Coal. Gases from Coal. Other Substances Derived from Coal. Varieties of Coal. Coal Tar and its Remarkable Products. Naphtha. Benzol. Creosote. Anthracene Oil. Pitch Coke. How Anthracene is Produced. Maury. Anthracene. Natural Gas in Iron Making, as practised in Pennsylvania. Orthoclase or Common Feldspar.—Meeting of the German Chemical Society, Berlin: Notices of several valuable papers, by Professor A. W. HOFMANN and other prominent Chemists.—Oxygen of the Air, by Professor LEIDY.	
V. NATURAL HISTORY, ETC.—Ancient and Extinct British Quadrupeds, by A. LETH BRADSHAW, M. D. An interesting paper.—Protective Ministry of Bats.—Nest of the Aye-Aye.—Nest of the Gaurami.—Electrical Eggs.—Re-eating Toads.—Cameron's Journey across Africa, with 5 illustrations.	

TERMS.—SCIENTIFIC AMERICAN SUPPLEMENT, one year, postpaid, five dollars. One copy of SCIENTIFIC AMERICAN and one copy of SCIENTIFIC AMERICAN SUPPLEMENT, one year, postpaid, seven dollars. CLUBS.—One extra copy of the SUPPLEMENT will be supplied gratis for every club of five SUPPLEMENT subscribers at \$5.00 each.
 All the back numbers of the SUPPLEMENT, from the commencement, January 1, 1876, can be had. Price 10 cents each.
 NOW READY.—THE SCIENTIFIC AMERICAN SUPPLEMENT for 1876. Complete in two large volumes. Over 300 quarto pages; over 2,000 engravings. Embracing History of the Centennial Exhibition. New Illustrated Instructions in Mechanical Drawing. Many valuable papers, etc. Price five dollars for the two volumes, stitched in paper; or six dollars and fifty cents, handsomely bound in stiff covers.

RECENT IMPROVEMENTS IN PHOTOGRAPHY.

Two interesting improvements, of promising practical importance, have of late been made public. The first relates to the production of negatives, for gallery and other work, without the use of the nitrate of silver bath.

The common method of photography, that universally practised in all galleries for portraiture, and for the best outdoor work, is known as the wet plate process. It consists in sensitizing the collodion plate by dipping in a liquid charged with nitrate of silver. The sensitization is effected in about three minutes' time; the plate is then withdrawn from the bath, quickly placed in the camera, and the picture taken and developed before the plate has time to dry. When all the chemicals are in good order, the bath pure, the exposure rightly timed, and the development skilfully done, the most beautiful results are produced. Indeed, there seems to be no room for improvement in picturesque details, as realized by the best wet plate operators.

But the method is attended with many inconveniences and irksome details. The gallery photographer must keep in readiness a first-class bath, the purity of which is lessened by every plate that goes in; and the bath soon requires renovation. The plates cannot be prepared and sensitized so as to be ready for use in advance of the opening of the day's business, but must be prepared and developed after the customer comes. Should the negative prove unsatisfactory, a new plate must be prepared and developed; and thus the bother of the plates involves the loss of so much time that the operator has little chance to consider the best positions for his subject or to study the artistic accessories that go to make up a finished picture. For outdoor work, wherever the photographer goes, he must lug his bath along, even to the mountain top, and must there have a dark tent, and water for washing and developing; otherwise his efforts are fruitless. For several years past it has been the study of photographers to discover a reliable method of preparing highly sensitive plates without the use of the bath—a method by which the plates could be used when dry. Among the results of these efforts are a variety of dry plate processes, some of which, in the hands of skilled operators, yield excellent results. But nearly all of them have proved less sensitive or less excellent in their results than the wet process; and none have been able to compete with the latter for portraiture or gallery work.

The French Photographic Society in 1876 offered a prize for the best dry process which should unite rapidity with all the other qualities that go to make a good negative. The competition was closed in December last, and the jury have recently awarded the prize to Mr. Alfred Chardon. The process appears to have advantages over some of its predecessors, but there are inconvenient details about the development and some uncertainty in the summering and wintering of the emulsion; while the prepared plates require twice as much time for taking the picture as the wet plate. Moreover, the process is not suitable for the ordinary routine work of the gallery.

The author of the new process which we have now to describe, and to which we would direct the attention of photographers as a complete and perfect substitute for the wet process, both for indoor, gallery, portrait, outdoor work, and all descriptions of photography, is Mr. Henry J. Newton, of this city, President of the Photographic Section of the American Institute.

We have seen the process worked under the author's hands and examined some of the results. We believe that practical photographers, when they come to examine the negatives and prints, will agree with us when we say that they are unsurpassed by anything as yet produced by the wet process. They will also agree with us that Mr. Newton's process is simpler, quicker, easier, less expensive, and more certain in the excellence of results than the old method. Moreover, for gallery and outdoor work, it presents the striking advantage of enabling the photographer to prepare in advance a stock of sensitive plates, and of keeping them on hand ready for instant use when wanted.

The Newton is an emulsion process. The silver is mixed with the collodion, which remains good for use at any time within a year or more. A glass plate is flowed with this collodion in the usual manner; the plate is then dipped in water; it is then ready for use either before or after drying. The picture being taken, it is developed by simply flowing the plate, in the ordinary manner, with a solution of carbonate of soda and pyrogallol acid; then fixed with hypo- or cyanide as usual. This is all the manipulation required for the most beautiful, clean, and splendid negatives. As to sensitiveness, the Newton plates require, in the gallery, less than half the time necessary for wet plates. Portraits by the Newton plates are taken in from five to ten seconds; while the wet process, same light and lenses, requires from twenty to forty seconds. For outdoor work, the Newton plates yield as good or better instantaneous pictures than wet plates.

The exact formula for the emulsion has not yet been made known by Mr. Newton, but will in due time be freely given to the public. It is sufficient for the present to say that the emulsion is prepared with an excess of free nitrate of silver, which is allowed to remain for a certain number of hours, when chlorides are added. The Scoville Manufacturing Company of this city supply the new emulsion, with practical directions for its use.

The second photo improvement relates to printing, and is that of Mr. William Willis, Jr., of Birmingham, England. The surface of the paper, sized with arrowroot, is first moistened for a moment with nitrate of silver solution (six grains to the

ounce) and dried. In this condition, the paper keeps for any length of time. The paper is further sensitized by coating with a solution of chloro-platinite of potassium and a solution of ferric oxalate. It is then exposed under the negative for only one sixth of the time required for a common silver print. The picture is then toned with gold, treated with hypo., washed, and finally placed in a weak solution of oxalic acid, again washed and dried. The permanency of these prints is remarkable. Mr. T. Rodger recently submitted specimens to the Edinburgh Photographic Society, which he said he had put to extreme tests. One of them, for example, had been subjected to sulphuretted hydrogen for twelve hours, and then to twelve additional hours in the acid solution employed to form the gas, all without change. We have lately had the pleasure of examining some of these platinum prints, brought to this country by the author, which in tone and color, were in every way equal to the best silver prints.

NEURALGIC STORM BELTS.

Dr. S. Weir Mitchell, a physician of Philadelphia, Pa., has recently conducted an important series of very interesting investigations with reference to the relations of bodily pain to the weather. It is an old popular idea that diseases and injuries of the bones, chronic rheumatisms, and ancient wounds produce a renewed pain on the approach of a storm; so much so, indeed, that persons thus afflicted frequently are able to predict impending changes of weather with remarkable accuracy. In the course of study of many of the curious symptoms belonging to the stumps of amputated limbs, Dr. Mitchell frequently encountered the above notion; and he became so impressed by the repeated testimony of patients, who stated that their comfort depended largely on the state of the weather, that he resolved to undertake careful research into the subject. He was fortunate enough to obtain the co-operation of Captain Catlin, U.S.A., who had lost a leg in action during the war, and had become a sufferer with neuralgia in the stump, the pain seemingly residing in portions of the absent foot. This officer kept records of his painful sensations, in connection with the weather reports as shown by the Signal Service, for three years; and he prepared elaborate maps and charts, showing just how certain attacks corresponded to certain periods of barometric depression and other meteorological phenomena. In brief, he conducted his self-examination with an accuracy and scientific thoroughness which cannot be too highly commended.

The result now adduced by Dr. Mitchell is that there is every reason to believe that the popular view which relates some pain fits to storms has a distinct foundation; but that, as the single element of mischief has not been detected, he is driven to believe that it is the combination of atmospheric conditions which starts the pain into being. The separate factors of storms, such as lessened pressure, rising temperature, greater humidity, and winds, appear as a rule to be incompetent, when acting singly, to give rise to attacks of pain. Either it is, as above stated, a combination which provokes the pain, or it may be some as yet unknown agency, acting alone. It was observed by Captain Catlin that his sensations of pain prevailed when the aurora was intense. Whether this was due to the magnetic or electric disturbance prevalent or to the succeeding storm, Dr. Mitchell thinks is questionable.

About the most striking conclusion reached is that relating to the neuralgic storm belt. Every storm, as it sweeps across the continent, consists of a vast rain area, at the center of which is a moving space of greatest barometric depression known as the storm center, along which the storm moves like a bead on a thread. The rain usually precedes this by 600 miles; but before and around the rain lies a belt, which may be called the neuralgic margin of the storm, and which precedes the rain by about 150 miles. This fact is very deceptive, because the sufferer may be on the far edge of the storm basin of barometric depression, and, seeing nothing of the rain, may yet have pain due to the storm. "It is somewhat interesting," adds Dr. Mitchell, "to figure one's self thus—a moving area of rain girdled by a neuralgic belt 150 miles wide, within which, as it sweeps along in advance of the storm, prevail, in the hurt and maimed limbs of men and in tender nerves and rheumatic joints, renewed torments called into existence by the stir and perturbation of the elements."

A NEW EXPLOSIVE COMPOUND FOR LARGE GUNS.

The dangerous element to a gun, from any explosion taking place within it, is the rate at which that explosion occurs. Stress due to a blow is very much more difficult to resist than strain gradually applied; and for this reason it is that the slow burning and comparatively weak gunpowder is retained when so many much more powerful explosives exist. No gun has yet been invented capable of withstanding the effects of explosion of gun cotton charges for any length of time, although abundant experiment has been made in this direction in the hope of substituting gun cotton for gunpowder. It is known that an immense advantage would be gained if the whole force of a nitroglycerin explosion could be concentrated on the base of a projectile; but the trouble is that no one has discovered how to harness nitroglycerin for artillery purposes; or in other words, no one has yet devised an apparatus whereby nearly the whole power of the explosion can be directed upon the ball, and merely a minimum left to act towards rending the gun asunder.

It follows from this that the theoretically most advantageous explosive for gunnery purposes is one which has an accelerating action, and that it must focus its power upon

the projectile, in a relatively gradual scale, through all the stages, and thus impart to the same the utmost possible velocity. Now, in the case of gunpowder, there is regular combustion, layer by layer; and the amount of gas developed depends directly upon the extent of the burning surface. Consequently, if the size of the grains be increased, the weight of the charge remaining the same, there will be less surface exposed to combustion, less gas evolved in the first instants of time, and less pressure on the gun. In gun cotton, however, there is, in lieu of combustion, a disintegration which occurs instantly throughout the entire mass; and thus, while the explosion of powder is such that it may be easily controlled, no mode of preparing gun cotton in any particular shape changes its peculiarity of instant detonation.

When a grain of gunpowder is fired in the gun, the first gas that is evolved starts the projectile; and as the latter travels, the combustion area of the powder is constantly augmented until, by the time the flame reaches the interior of the grain, the small remainder of the same is incompetent to evolve by its combustion gas enough to compensate for the increased area over which it must act. Hence that nucleus of the grain serves no useful purpose, and certainly affords no acceleration to the shot: but in the new "compensating" powder, which Captain Charles A. L. Totten, U.S.A., has devised, this nucleus is made to render an accelerating force through being formed of gun cotton, which, exploding in an increased area, exerts little strain on the gun, and checks the tendency of the gas to lose its tension, thus compensating for the increasing space in rear of the projectile. Not only does the inventor claim for this compound explosive high impulsive power, but he states that the waste of large grained powder, which is blown out of the gun with the grain still burning, often reaches 60 per cent of the charge, and that this is saved by the addition of the gun cotton nucleus. In general, he affirms that the combined gun cotton and powder is lighter, and four and a half times more effective, charge for charge, than gunpowder. If this can be substantiated by experiment, there can be little question but that the new explosive will be of the greatest value in modern large artillery, in which gunpowder has been proved too weak to project the immense shot and shell with proper effective velocity. Captain Totten finds, by test, that no chemical change attributable to the mutual action of gunpowder and gun cotton occurs in his powder. The gun cotton nucleus is spherical, and half an inch in diameter, the powder envelope raising the diameter to one inch. No special machinery has yet been invented for its manufacture.

We may add that the present is the time for inventors to turn their attention to inventions of this class. The war in Europe will result in a great demand for improved arms and explosives of all kinds; and an efficient substitute for gunpowder in cannon, which shall be much stronger in its effects and at the same time as easily controlled, would be of the greatest value to both contending parties.

WHY FRESH WATER FISH CANNOT LIVE IN SALT WATER.

It is well known that fresh water fish cannot live in salt water, and *vice versa*; and it has been supposed that the reason existed in some poisonous effect which the inappropriate water exerted. M. Paul Bert has recently been investigating this subject, and his conclusion is that the death of the creature is not due to any toxic action, but is simply a phenomenon of osmosis or transmission of fluids through the membranes. In order to prove this, it is only necessary to weigh the animal before and after the experiment. A frog, for example, plunged in sea water loses one third its weight. If only the foot of the frog be introduced, the blood globules can be seen to leave the vessels and distribute themselves under the skin. If an animal be taken, the skin of which is not entirely osmotic, the same phenomena occur in the bronchial system.

There are certain fish, however, which exist sometimes in salt, sometimes in fresh, water, changing their habitat in different periods of life or of the year. It therefore, in view of the above, becomes interesting to see how M. Bert applies his discovery to such apparent exceptions to the general rule. A fresh water salmon, for instance, plunged abruptly in sea water, resists the effects longer than other fresh water fishes; but he dies within five or six hours. This shows, according to M. Bert, that the fish never proceed suddenly from fresh to salt water, but enter brackish water where the tide ebbs and flows, and live there a sufficient time to habituate themselves to the change. This accounts for the frequent discovery of large numbers of such migratory fish in the vicinity of the mouths of the rivers which they ascend.

A fresh water eel, plunged in salt water, does not seem to be affected. But in investigating the peculiarities of this species, M. Bert was led into a wrong conclusion, which may be cited to show how easy it is, often by pure accident, to reach an erroneous determination in laboratory experimenting. After having himself placed several fresh water eels in salt water, he found, as already stated, that they remained alive and unharmed. Wishing to continue the experiments, he directed his assistant to introduce the fish, and report results. To his surprise, the eels then persistently died after a three or four hours' sojourn in salt water, and long search failed to discover the reason why it was that, when M. Bert placed them in the tanks, they lived, while, when the assistant did so, they perished. Finally M. Bert found that his assistant, doubtless on account of the slipperiness of the eels, lifted them with a piece of cloth in his hand. The cloth rubbed off a little of the natural slime of the animal, which

protected it from the salt water. Osmosis then occurred in the denuded portion, and the eel eventually died.

The converse experiment, of inserting sea fish in fresh water, produced analogous results. The gills were the seat of alterations, the same as those noted in fresh water fish placed in salt water. M. Bert also observed that the life of the sea fish could be prolonged by adding salt to the fresh water, thus adding further confirmation to his theory.

"LOST HIS AMBITION."

We met, the other day, an expert workman who said that he had lost his ambition. "Where is my incentive?" said he. "I am only a mortal, just like other men. Energy among others is a means to an end. Health, fame, ease, and luxury are the prizes for which men strive. Show me the man who is energetic in a single cause in which one of these is not the aim, the incentive, and the reward, and answer me honestly how can I make an exercise of more than common energy or industry subservient towards giving me one of these prizes."

"You will never be out of work and will always command respect," was the answer. He smiled, and holding a scraper in one hand and a file in the other, replied: "I never was out of work a day; I am too well known. I put forth my energy when I want work, and get it at once. Having got it, I work along easily and pleasantly; am always on the best of terms with my employer, get the best wages, work ten hours a day, and jog discontentedly along, my ambition, energy, and extra ability rusting away for want of the incentive which all men require to call forth more than ordinary exertion. Now, where is my remedy?" "Piecework," was the suggestion made in reply.

"You have struck it," was the response. "When I worked on piecework, the work I did seemed mine; every job well done brought me more work; I engaged other men, and taught the boys all I knew; every scrap of information I gave to my men or boys brought me in money by increasing their skill; every extra dozen blows I struck were represented in my wages on Saturday night. I looked well ahead at my work, often preventing blunders from being committed; I was a hardworking, happy man, putting by something for old age. But where am I to get piecework now? One establishment has been working short time, another is doing little or nothing, and most of the others don't see the advantages of the piecework system, which can and has been carried to the greatest of success, even in repair shops."

We have often suggested piecework, but the reply is that it cannot be adopted in a repair shop or on promiscuous work. Why not? An average job, even in a small shop, lasts a day; and how much trouble would it be to estimate the value and keep an account (in a small shop) of six jobs a week? Any job done in a shop a second time can be estimated upon for piecework. Sometimes people say: "We do not know what the job is worth." Of course they do not. If a man ties his arm in a sling, he must expect it to grow weak. Just the same with the judgment and perception: men used to piecework can estimate how much there is in a job down to an hour's work in a week; but men who never give the subject a moment's thought cannot. "When I'm too old to work at all," said our friend, "there will be no such thing as daywork, except for laborers."

How to Live Long.

The desire for length of days seems to have been far greater in times past than it is now. With a view of bestowing some timely hints on our active business men, who are rushing on in pursuit of riches regardless of the exhaustion of their physical and mental faculties, our contemporary the New York Sun publishes a lengthy article, from which we condense the following:

Nearly all the principal writers on longevity are agreed that human beings may, under the most favorable conditions, live to a hundred, and several have recorded instances of persons reaching a much greater age; but the instances given do not in any case satisfactorily bear rigid examination. Hufeland, public lecturer at Jena, who published a work on longevity in the last century, thus describes the sort of man who has the best prospect of long life: He has a well proportioned stature, without, however, being too tall. He is rather of the middle size, and somewhat thick-set. His complexion is not too florid—at any rate, too much rudeness in youth is seldom a sign of longevity. Hair approaches rather to the fair than to the black; his skin is strong, but not rough. His head is not too big. He has large veins at the extremities, and his shoulders are rather round than flat; his neck is not too long; his belly does not project, and his hands are large but not too deeply cleft. His foot is rather thick than long, and his legs are firm and round. He has also a broad chest and strong voice, and the faculty of retaining his breath for a long time without difficulty. In general there is complete harmony in all his parts. His senses are good, but not too delicate; his pulse is slow and regular. His appetite is good, and his digestion easy. He has not too much thirst, which is always a sign of rapid self-consumption. His passions never become too violent or destructive. If he gives way to anger, he experiences a glow of warmth without an overflowing of the gall. He likes employment, particularly calm meditation and agreeable speculations—is an optimist, a friend to Nature and domestic felicity—has no thirst after either honors or riches, and banishes all thought of to-morrow. This power of banishing anxiety has an immense deal to do with longevity.

It is, in fact, that "management of the mind" which Dr. Johnson so justly told Boswell was "a great art," adding that a man when miserable should not go to his chamber and try to think his trouble down, but should seek every possible means to divert it. Dwelling on misery at once affects, and most seriously, the digestive organs.

There are not a few people the very fineness of whose constitution proves their ruin. They draw so extravagantly upon their powers that they are dust and ashes forty years before the creaky wheels who started in the race with them have done running. In this country we discount our future more heavily, perhaps, than in any other; not by dissipation, but by overtaxing our energies. A very large proportion of men who die rich here die twenty years before they ought if they had properly husbanded their vital resources. Mr. Macy, the well known fancy dealer, was, we believe, only 56 or 58, and had been slaving his whole life; in fact, his complete break-up was explained by his intense toil. Such a career seems like getting very little out of life. A still more striking instance of the kind was that of Mr. Augustus Hemingway, of Boston, who worked himself into a lunatic asylum, whence he came worth some \$15,000,000, only to get into his grave a few months later. We doubt whether the history of the world could show a more reckless disregard of life than is shown by commercial men in this country. The science of combining intense application with those habits which conduce to longevity is one that they have not acquired. That it may be acquired cannot be doubted. Newton lived to a great age; and great lawyers have been famous for long life. There seems to be a lack of wisdom in commercial men as to the real value of life. They put a wholly inordinate estimate upon the power of getting and spending.

Rest assured that there is, in brief, only one golden rule to be followed by all who seek longevity—moderation in all things, and management of the mind.

Preparation of Phthalic Acid.

A convenient method for the preparation of phthalic acid for the laboratory is given by Häussermann in *Dingler's Journal*, page 310. A mixture of one part naphthalene and two parts chlorate of potassium is thrown, small quantities at a time, into five parts of common hydrochloric acid; and the brownish-yellow products, a mixture of addition and substitution products of naphthalene, is thoroughly washed with lukewarm water by decantation. The mass is then dried at a gentle heat to prevent its freezing together, or, as Böttger suggests, it is pressed between white blotting paper,* and then shaken in a flask with petroleum ether (naphtha) to remove the liquid chlorides mixed with it and inclosed within the mass. After filtering and washing with naphtha, and drying the mass, which consists chiefly of tetrachloride of naphthalene, is snow white. It is heated in a sand bath with five or six times its weight of nitric acid, which should not be stronger than 1.25 specific gravity. Several hours are necessary to render the liquid homogeneous. After expelling the excess of nitric acid, it is allowed to cool, when the phthalic acid crystallizes out. The acid is purified by recrystallizing it several times from hot water.

If the nitric acid employed to decompose the tetrachloride of naphthalene is stronger than 1.35, the reaction will go on more rapidly, but an easily perceptible quantity of nitronaphthalic acid is formed, which cannot be easily separated from the phthalic acid.

To convert the phthalic acid into the anhydride, it is only necessary to fuse it and keep it at a temperature of 180° C., or 356° Fah., as long as moisture escapes, although some of the anhydride may sublime off. If the temperature has not exceeded 180° C., the residue will consist of anhydrous phthalic acid pure enough for the manufacture of fluoresceine and other compounds. By this method, 80 parts of the anhydride can be obtained from 100 parts of naphthalene. To make it perfectly pure, the acid is boiled with water, and the anhydride purified by sublimation.

For the preparation of phthalic acid on a commercial scale, the method above described is quite expensive, owing to the cost of the materials employed; but for laboratory use and experimental purposes this method is worthy of a trial.

New Weighing Instrument.

The ordinary chemical balance is, of course, rather a costly instrument, it being difficult to make the two halves sufficiently alike, and to combine stability with sensitiveness. M. Payer proposes the following arrangement for small weights. A two-armed tube is filled with mercury, and on one of the mercury surfaces is placed a well fitting plate, which can move in the tube without friction. This serves as the balance scale, and the body to be weighed is placed on it. The liquid will rise in the other arm correspondingly, and equilibrium is at once obtained with great certainty. Place a known weight, 1 grain, for example, and note how high the mercury rises. Then place a second grain and note the additional rise. Going on in this way, a scale may easily be constructed. As for each rise in one arm there is an equal sinking in the other, this scale can be applied to the other leg also, of course in opposite direction. The sensitiveness of the arrangement is considerable. It can be increased by use of the Torricellian vacuum, the plate, with the body to be weighed resting, in this case, on the mercury in the open arm. The scale can here have no fixed zero, since the air pressure varies, which is only a slight inconvenience.

* We suggest the use of infusorial silica to absorb the moisture.—Eug.

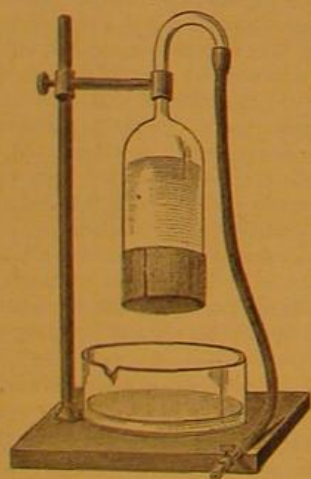
WATER HELD IN A CAGE AND BOILED IN A SIEVE.

If Mr. Romilly has not succeeded in performing the feat of navigating the sea in a sieve, which in the days of witchcraft was supposed to be the chief accomplishment of the professor of the black art, he has done something apparently as wonderful in lifting water in a sieve, holding it in a cage, and afterward boiling it in the former receptacle. Of course there is nothing really marvelous about the performance, when the natural laws which govern it are considered; but as a series of admirable experiments in capillary attraction, it is none the less striking and remarkable.

Mr. Romilly's investigations were undertaken with a view of determining whether a tissue or sieve extended beneath a bell glass filled with water would sustain the water in the glass, the idea being suggested by Mr. Jamin's successful experiments in sustaining water in numerous fine capillary tubes. A bell glass about 8 inches in diameter was closed with a bobbet having large meshes, each from 0.08 to 0.12 inch square. The glass was then placed mouth downwards in a vessel of water; and by exhausting the air above the water was drawn up into the cylinder to the desired height. The air pipe cock was then closed. On removing the glass, the water was maintained therein, and at each mesh of the tissue appeared a water meniscus, while a large general meniscus formed in the center of the fabric. The height of the water in the glass was immaterial to the success of the experiment. A large tube, 8 inches in diameter, and 6.4 feet long, was closed above with a rubber stopper, through which the aspirating pipe passed. Water, entirely filling the tube, was sustained by the aid of a piece of extremely fine lace fastened over the lower end.

If, instead of securing the tissue over the mouth of the tube or glass, it be held in place by the hand, the water above is still sustained, while the shape of the meniscus below can be changed at will. By gradually lowering the fabric by slowly sliding the hand down the glass, the meniscus is caused to enlarge; and with a bell glass 2.4 inches in diameter, and lace having meshes, 0.8 inch square, the meniscus assumes a curve of from 1.2 to 1.6 inch in depth. This curvature augments with the fineness of the meshes. On this another interesting experiment is based. A square of wire gauze, the edges of which extend beyond the sides of the glass, is held against the mouth of the same by the finger during the aspiration of the water. On lifting the bell glass, the finger is removed, when the gauze remains in place, and the water is sustained as well as if the fabric were permanently fastened. The gauze may be replaced by a ring of metal of the same diameter, over which lace is stretched. When the fabric is perfectly horizontal and fastened in place, if the bell glass is inclined, the water runs out, but the degree of inclination seems to depend upon the size of the meshes. Thus with meshes 0.16 inch square, the least inclination determines the escape of the water; with those 0.04 inch square, an angle of 45° may be safely attained; while with meshes of from 0.02 to 0.03 inch square the following experiment may be accomplished: A glass tube of from 1.2 to 1.6 inches in diameter has, attached to its end by sealing wax, a little hemispherical tea strainer, such as is frequently suspended from teapot spouts to prevent tea leaves entering

Fig. 2.

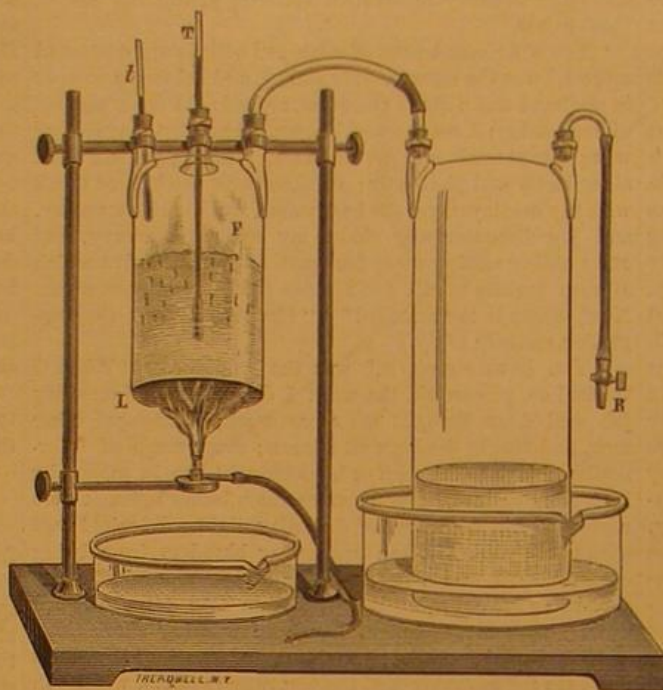


the cups. In the other end of the tube are a rubber stopper and an aspiratory pipe, as already described. The tube now being filled with water, the latter is maintained by the strainer even if the tube is turned to 45°, or reversed, provided no air bubble is allowed to touch or traverse the metallic gauze. In other words, when the tube is turned with the strainer uppermost, the water is held in the latter as in a cage. The sides of the latter may be from 1.2 to 1.6 inches high with wire gauze of meshes 0.04 inch square; if the meshes are 0.02 inch square, the height may be 2.8 to 3.2 inches.

Another curious experiment is illustrated in Fig. 1. A large bell glass is continued downward by a piece of wire gauze 1.2 inches in length and of the same diameter as the glass. The meshes are 0.04 inch square, and the fabric extends across the bottom. If, after having filled the cylinder with water, the horizontal base only is placed on a surface of water, and the air pipe above is opened, the water in the glass will run out. If then, before the level of the escaping

water has passed the bottom of the glass, the aspiration pump be started, the water will remount in the glass, and not a single air bubble will enter through the side of the wire gauze addition, although that portion is wholly exposed. And further, the water level may be allowed to descend half the height of the gauze addition; and yet, when the pump is set in motion, no air will be drawn through the wire gauze, a thin pellicle of liquid seemingly cutting off access of the atmosphere, while the water rises in the glass as before. With wire gauze, having meshes from 0.02 to 0.03 inch square, this effect is augmented, and the water level may be allowed to fall 1.6 inches below the bottom edge of the bell glass.

The temperature of the meniscus formed does not influence its resistance. A bell glass, covered below with gauze which sustained the water, was placed over a gas burner. The flame spread over the watery surface, and the water boiled without falling. An almost invisible gauze



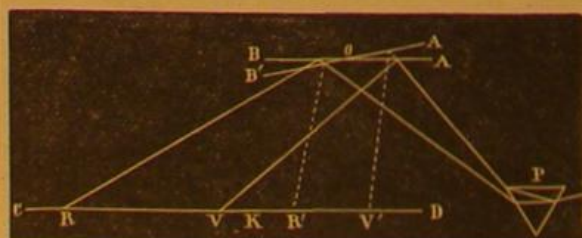
ROMILLY'S EXPERIMENTS IN CAPILLARITY.—Fig. 1.

suffices for this experiment, and it may be either affixed to the glass or attached to a metallic ring and simply applied, as already described. When ebullition becomes violent, the water falls; but by regulating the flame by the indications of a thermometer in the bell glass, lowering the heat when 212° is exceeded, the experiment may be indefinitely continued. In order to insure success, however, it is better to connect the bell glass in which the water is to be boiled with another plunged in a vessel of water. The two glasses are connected so that the water is drawn by aspiration into each simultaneously. The dilatation of the heated air then distributes its effect over both glasses and the water does not fall. The water is likely to fall little by little, with a single glass, as steam is raised. Fig. 2 shows the disposition of apparatus for the above experiment. The bell glass, F, has three necks, and is 6 inches in diameter. T is one thermometer, for denoting the temperature of the water, and t is another, for showing that of the air. The gauze is held in place beneath F by a simple rubber band.

Neither before nor during ebullition do the meniscus bubbles become displaced, to rise to the surface. As it is necessary to replace the water in the glass which may be evaporated during the boiling, this may be done in a curious way, in keeping with the odd nature of the entire series of experiments. As soon as ebullition is well established, and the water level has somewhat fallen, a curved pipette is filled with cold water, which is ejected therefrom in a jet against the gauze. The jet penetrates the gauze and the level is quickly re-established.

A NEW EXPERIMENT FOR THE SYNTHESIS OF SUNLIGHT.

M. Laroit de Lestrade has recently exhibited before the Scientific Congress of Clermont-Ferrand, France, a very beautiful and simple experiment for recomposing sunlight from the spectrum. This experiment is now very imperfectly done by Newton's disk, which is painted with segments of different colors, proportional in extent to the area occupied by the colors respectively of the spectrum; and this is rotated rapidly, so that, by the superposition of a number of colored impressions on the retina, a sensation of



white is produced. The trouble is that the apparatus never has and never can accomplish its object; because it is almost impossible to distribute the colors in accurate proportion,

and because no pigments ever can approach the spectrum colors in brilliancy and purity, and hence, when combined, can never produce white, but only a dull indefinable gray. M. de Lestrade retains the idea of superposing the prismatic hues in the retina, but he uses the split-up sunbeam itself and not painted representations. P in the annexed diagram is the resolving prism, and the spectrum is received on a rectangular mirror, A B, located eight or ten feet distant. The spectrum is therefore reflected upon the screen, C D, say from R to V. Now suppose the mirror to be slightly turned on a vertical axis to A' B'; then the reflected spectrum will be moved along to R' V', and any point, K, on its path must therefore be traversed by all the spectral colors in succession. Rotate the mirror rapidly, and the rapidity of colored impressions, produced on the eye gazing at K, will produce the sensation of white light. Two mirrors, placed back to back, are of course better than a single mirror in causing the quick displacement of the colors.

One advantage of this admirable experiment—which is, without exception, one of the most ingenious that have ever come under our notice—is that it may be employed for the study of the combinations of the various prismatic colors. For this purpose, a metal screen having a rectangular aperture large enough for the passage of the whole spectrum is suspended a short distance in front of the mirror. Small movable screens of various dimensions are hung before the opening so as to intercept such colored parts of the spectrum as are desired to be stopped out. Then, by turning the mirror, a mixture of colors is obtained very easily, and without reference to their relative proportions in the spectrum.

Moles.

A correspondent of the *Ohio Cultivator* says: "There are two kinds of moles in this country—English and American. The English mole is rather small, with short, thick, blue fur; its feet are large, broad, and powerful, used in burrowing; its nose is also very strong, for the same purpose. It runs in burrows, underground generally. I have seen it, when plowed up in corn fields, burrow under the loose soil rapidly, simply by the use of its nose, going, even in hard ground, faster than a dog can follow by digging. I suppose this mole hibernates in extreme cold weather, as I have not noticed it during the colder part of this last winter. I think for this reason that its food must be chiefly worms and insects, as these are all gone in cold weather."

"The other mole is about as large as a half-grown rat. Its fur is grayish brown on the outside, but blue close to the skin. Its feet are not so large or powerful as those of the English mole, and its runs are mostly on the surface of the ground, under grass, weeds, or rubbish. Its nostrils are extended beyond all other parts of the nose. Its smell is very acute, also its hearing, but its vision is poor, making it depend upon its smelling and hearing for its principal guides in the rapid pursuit of insects. The mole's mouth has, in the fore part, four long sharp incisors—two in upper, two in lower jaws, like the squirrel and other rodents. In the back part of the jaw, at this season of the year, the teeth are flat and square, like the grain-eating animals—not rounded and sharp as in the animals entirely insect-eating. So their teeth must have come in contact with some hard substance which ground off the sharp points. Again, they have a double stomach, large and small intestines, etc., while the animals of entirely insect-eating habit have a small and simple stomach, and scarcely any intestines save the oesophagus and pylorus."

IMPROVED FISH SCALER.

The annexed engraving represents a convenient hand implement for removing scales from fish, and for scraping them after the scales are loosened.



A thin metal blade has one edge provided with teeth which are similar to saw teeth, while its opposite edge is plain. This blade is bent to a semicircular form, and its ends are secured to the opposite ends of the head or block, A, this forming a scraping tool which can be very conveniently handled. To the opposite end of the handle is secured one end of a cord, to which is attached a long pointed rod or spear, B.

In cleaning a fish the spear is forced through the tail and the point pressed into the table underneath. The operator then loosens the scales of the fish with the toothed edge of the blade by drawing the implement over the body of the fish from the tail to the head. When the scales are loosened, the implement is turned over and the fish scraped with the plain edge.

Patented February 22, 1876, by Mrs. Sarah Lawton, of San Francisco, Cal.

THE PAPYRUS OR PAPER REED.

The papyrus plant or paper reed, an engraving of which (taken from Knight's *New Mechanical Dictionary**) is here presented, belongs to the family of *cyperaceae* or sedges, nearly related to the grasses, and as remarkable for the small number of its useful plants as the grasses are for their many valuable species. It was called *papy* by the Egyptians, whence the Greek *papyrus*, the Latin *papyrus*, and our word *paper*. It grows on the marshy banks of rivers in Abyssinia, Syria, and Sicily, and formerly abounded on the banks of the Nile; but at present it has nearly disappeared from Egypt. The plant has large and abundant root stocks, which spread in the mud and throw up numerous stems from five to ten feet in height, the lower portion being submerged; the stem is triangular and smooth. The leaves all spring from near the base, the upper part of the stem being quite naked and bearing its inflorescence at the apex in the form of a large compound umbel. This consists of numerous slender branching peduncles, bearing at their extremities the flowers in small heads or spikes, and forming a graceful, drooping tuft, which has at its base numerous long narrow leaves.

In making paper, the inner cuticle of the stalk was separated into thin *laminae* by a sharp point. The finest were those next the pith; and the layers, of which there were about twenty, decreased in quality as they approached the outer integument, which was coarse and fit only for making cordage, mats, etc. The slips were laid side by side on a smooth flat surface, and covered with a second layer placed at right angles to them, after which they were pressed so as to cause the different *laminae* to adhere to each other and form a single sheet, which was then dried in the sun. It is said that the layers were made adhesive by wetting them with Nile water, to which Pliny ascribes a glutinous quality. The sheets were finally beaten smooth with a mallet and polished with a piece of ivory. When finished, the papyrus was rolled upon a wooden cylinder, the ends of which, projecting beyond the edges of the sheet, were neatly finished and ornamented.

The papyrus plant was used for a great variety of purposes besides paper. Its graceful plumes crowned the statues of the gods, and decorated their temples: its pith was eaten as food: wickerwork boats, boxes, and baskets were woven of its stalk; and of its bark were made sails, cordage, cloth, mats, and sandals for the priests. It was applied as medicine to the cure of fistulas and ulcers; it furnished material for torches and candles, and its roots were used for fuel and manufactured into furniture and household utensils.

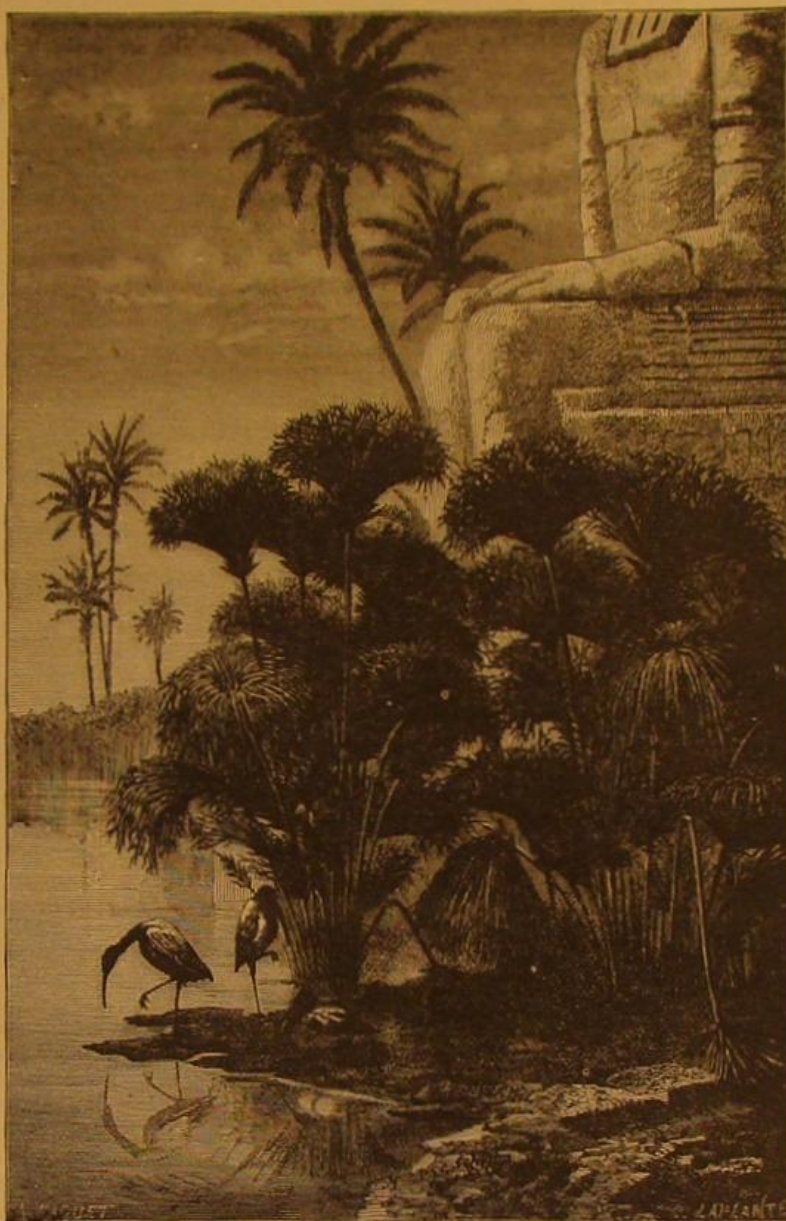
Fireproof Walls.

The report of a committee of the National Board of Underwriters, giving the palm to the fireproof quality of brick as a material for buildings, is strikingly confirmed by our own experience. The walls of the *Journal of Commerce* building, though exposed in the upper parts to an extremely intense heat for nearly two hours, prove to be but slightly injured. A few trifling cracks, readily repaired, near the roof, are the only signs in the walls of the ordeal through which they have passed. The walls were strongly constructed, intended to last, and they have served their purpose. Had the structure been made of granite or marble or iron we can guess what would be its present condition from the fate that has overtaken so many buildings composed of those materials. The report of the Fire Underwriters' Committee makes no new points; but it presents again in a very convincing manner some of the evidences, which ought to be heeded, as to the superiority of brick over stone or iron for building purposes. One of the most impressive proofs given is that offered by the great fire in Boston in 1872, when the rear brick wall of the new Post Office Building in that city was exposed to a terrible direct heat for hours without sustaining a crack or blemish of any kind; whereas the granite side of the structure, not facing the fire, was seriously damaged, and it was necessary to take down portions of it. The report strongly condemns the use of iron in architecture, declaring it "undesirable for such purposes, and unsafe in a fire point of view." The recent destruction of large iron edifices in New York and St. Louis is cited as testimony on this head. The wreck of the iron building burned in Bond street of this city last winter was a quick piece of work; but St. Louis beat it at a fire last month, when one of the largest iron structures in that city lay flat on the ground within twenty minutes after the fire was discovered in it. The committee say that wooden columns, pillars, or supports of proper dimensions will stand fire better than iron. They recommend, for fireproof doors or shutters, wood clad with sheet iron or tin. These are all practical sugges-

tions worthy to be heeded by architects and owners of buildings. And they will have almost the force of law in the community if they are made the basis of discrimination in insurance rates adopted by the companies.—*New York Journal of Commerce*.

The American Inventor.

The *British Trade Journal* says: "The ingenuity of the American inventor is a curiosity in itself. Having exhausted the credulity of the customers for wooden nutmegs, and the ligneous ham having proved a failure, the New Englander has lately been devoting his sharp intellect to inventions nearly as profitable and rather more reputable. A few years



THE PAPYRUS.

ago soft felt hats were extensively worn in the United States. They were very pleasant, but had the one fault of getting limp and slouchingly unsightly in the brim. It struck a keen New Yorker that a bit of galvanized wire run around the brim would not only obviate this, but give the beaver the desired cock at will. No sooner thought of than done, and no sooner done than patented. Luckily a patent does not cost quite so much in the United States as here, and the lucky inventor is said to have netted a fortune. Now we hear that the genius who first brought out wooden toothpicks has made \$50,000 by his little manufacture. At first, if the universal traveler's tale be true, a fork, or the all-useful bowie knife, served this purpose. But, as the country advanced in luxury, the demand for a weapon more civilized and a little lighter became universal. Found the demand, the man who was to satisfy it soon appeared. At first the toothpicks were made of hard, fibrous wood. But this, we are told by New York journals, did not serve. The hickory toothpicks lasted too long. Latterly he has been making them of soft pine wood, and with a great increase to his gains, for it now takes four sound picks to get the broken end of one out from between the teeth. This almost equals the genius who, finding no sale for his cargo of shoe pegs in Philadelphia, whittled the other end, and sold them for oars in New Orleans. At least, so we read in an American newspaper, and all the world knows how jealously they cling to the truth."

Action of Sea Water on Lead.

The *Journal of the Chemical Society* says that, after keeping strips of new cut lead in a bottle of sea water, frequently shaken, for four days, no trace of lead could be detected in the water, but the bright surface of the strips was coated with an insoluble lead compound. Hence, lead pipes may be used in marine aquaria without any fear of injury to their inhabitants.

Gardening all the Year Round.

Under this heading, D. H. Jacques, Esq., contributes to the *Semi-Tropical Magazine* some timely hints to agriculturists, from which we make the following extracts:

Watering so as to merely wet the surface of the ground often does more harm than good. The roots of the plants are thereby attracted to the surface, thus temporarily moistened; but as it soon becomes as dry as before, and harder than ever, the young roots perish in the intervals of watering, and the plant is weakened rather than strengthened, and not infrequently killed outright. The ground should be well soaked and the watering not frequent. In the case of trees, shrubs, and large herbaceous plants, it is well to draw away the surface earth from them to the depth of two or three inches, doing it carefully, so as not to injure the roots, apply the water, and then return the dry soil. This prevents immediate evaporation and gives the roots the full benefit of the water, without exposing them to be burned up by the hot sun. Where this is not practicable, as among small plants, holes may be made near them with a dibble or sharpened stick, and water poured into them from the nozzle of a watering pot. The plants may afterward be slightly sprinkled from the nose of the pot and the ground stirred with the prong.

Salt-peter, a tablespoonful or more to a bucket of water, is an excellent occasional application to most kinds of garden plants, being at the same time a fertilizer and an insect destroyer. Many grubs and bugs may be destroyed by copious waterings with this solution.

To keep plants bearing: The production of seed is an exhaustive process, and, as a rule, its completion is signalized either by the death of the plant, if an annual, or by a temporary suspension of the process of growth, if a biennial or a perennial. The immediate end for which Nature has sustained it has been attained. If we are cultivating it for seed, our object is the same, and we should not interfere with Nature's processes; but if, as in the case of the okra, the cucumber, and the summer squash, we make use of the immature fruit and desire to increase and prolong its production, we must carefully cut off, before maturity, all that is produced, whether we can make use of them or not, so as to encourage an abnormal production. Also, where a root or a bulb is the object of cultivation, as in the Irish potato or the onion, we should remove the flower stems. If seeds are desired, certain plants should be set apart for their production and the earliest and best fruit be allowed to ripen. The same rule applies to the flower garden. If we desire continued bloom, the plants must not be allowed to mature seeds.

Moss for potted plants: It is beneficial, at this season, to cover the earth around plants in pots and baskets with a layer of fresh moss, to be changed as it becomes dry and dead. It keeps the moisture from evaporating, secures a greater uniformity of temperature, and improves the looks of the plant.

Transplanting: Tomatoes, peppers, and egg plants should be transplanted, as required to keep up a succession of fruit, choosing showery weather for the operation, or watering and shading as heretofore directed. In light, porous soils, transplanting becomes a work of some delicacy and difficulty, as the summer advances, especially when the rains are light and infrequent, as is often the case at this season. See previous hints on this subject.

Flower garden work: In the flower garden the operations of the month are mainly the same as in the vegetable garden. Stir the soil, kill all weeds, transplant, shade, and water. Liquid manure is here fully as effective as in the kitchen garden, giving wonderful size and brilliancy to the flowers. Rose and other bushes will be much benefited by a top dressing of pulverized charcoal and ashes composted with rotten muck or surface soil from the woods.

The Great Eastern to be a Meat Ship.

The owners of the Great Eastern are, it is said, considering the propriety of converting that magnificent vessel into a huge refrigerating chamber for the conveyance of American meat. A recent examination has disclosed the fact that, like the Great Britain—another of Brunel's ships—the hull is practically in as good condition as when first built, and the directors consider it would be wise to raise sufficient money to put new and improved engines and boilers into the vessel. They have been empowered to prepare a rough estimate of the cost of the new machinery; and in view of the fact that the vessel can even now steam as fast as any of the Atlantic liners, the trade in meat, which is being developed not only with the United States, but also with Brazil, promises to open a wide field of usefulness—a trade in which the great vessel need never carry only half a load.

* Published in numbers by Messrs. Hurd & Houghton, New York city.

Communications.

Our Washington Correspondence.

To the Editor of the Scientific American:

Business in the Patent Office still continues brisk, and a larger number of patents than usual are being issued—the average weekly list for the last three weeks being 352, including all issues.

The competitive examination for the vacant position on the Board of Appeals resulted in the names of Messrs. Bates, Wilbur, and Catlin (as the three best on the list) being reported by the Examining Board to the Secretary of the Interior, who nominated the first named gentleman to the President for appointment; and he was accordingly appointed to the position. Mr. Bates being Examiner of Interferences, it became necessary to appoint some one to fill his place; and Mr. Wilbur, as second on the above list, was appointed to this position. This creates a vacancy in the primary examining corps; and now there is to be another examination to fill the place made vacant by Mr. Wilbur's promotion, which will probably take place ere this is published.

The Coast Survey Office is now fitting out two parties to survey the coast of Maine: the first party under Lieutenant Moser, U.S.N., on the steamer Endeavor, and the other under Lieutenant Hawley, on the schooner Ernest. A third party is being fitted out for the purpose of making off-shore tidal current observations in the same locality, under Acting Master Robert Platt, on the schooner Drift.

The question how to survey, economically, the occasional spots of arable land which dot the sterile deserts in the far West has engrossed the attention of the Land Office for several years. The practice has been to extend one of the main base lines and one of the principal meridian lines until they intersect in the vicinity of the spot to be surveyed, and from this point continue the survey by laying out townships, sections, etc. This often involves running lines through desert lands, for hundreds of miles, at great expense; to save which Lieutenant Powell, the explorer, now proposes to arrive at the initial point for this kind of lands by triangulation, which can be done at much less expense and with equal precision. It is thought, however, that the law as it now stands will not allow of this being done; and it is probable that the subject will be submitted to Congress at the next session for consideration, and the necessary change in the law.

Many agents of the different European governments are reported as scattered over the country, engaged in buying up all the white oak timber in the market ready for shipment. The French Government has recently made large purchases in Norfolk and other Southern ports; the English agents are busily negotiating for all they can find in New York, Philadelphia, and Baltimore; and Russian agents are securing all they can find wherever it is to be purchased. Ex-Secretary Robeson was very much blamed by the opposition press for making large purchases of this material during his official term; but now the different foreign agents are willing to pay the government double what he gave for it.

There is now being erected in the Mineral Hall of the Smithsonian Institute some remarkable specimens of the plastic art. One of these is a copy in terra cotta of the group "America" upon one of the pediments of the Albert Memorial in London. The figures are of heroic size, and are probably the largest ever made in this material. There is also a pulpit, with the steps leading thereto in red and white terra cotta, relieved by gilding; and two fonts of the same material. The sides of the pulpit are ornamented with scenes representing the life of the Saviour, and the fonts with scenes connected with children from the Scriptures.

Washington, D. C.

OCCASIONAL.

A New Remedy for the Potato Bug.

To the Editor of the Scientific American:

In the spring and summer of 1875, in experimenting with the Colorado potato bug and the action of certain chemicals on the bug and its eggs, I discovered that a solution of the sulpho-carbonate of potassium in water had the property of dissolving the skin or covering of the eggs. When this solution was applied to the potato plants on which there were eggs, that part of the leaf on which the eggs were would be turned brown and dead, and the eggs (which are generally on the under side of the leaves) would be dissolved and run into a pasty mass which soon dried up.

It is not necessary for the solution to come in direct contact with the eggs; for when it was applied to the upper part of the leaves, the eggs on the under side would be dissolved as effectually, though not quite as fast, as when the solution was applied directly on them.

I do not remember having seen any notice of this action of the sulpho-carbonate of potassium on the eggs of insects; and it occurred to me when I read the article in the SCIENTIFIC AMERICAN of April 28, page 261, by Professor C. V. Riley, on the grasshopper, that this salt might prove as effectual a remedy for the grasshopper, by destroying its eggs while they are in the ground, as it has proved for the phylloxera in France. In the SCIENTIFIC AMERICAN SUPPLEMENT, No. 24, page 536, there is a copy of an article, read before the French Academy of Sciences by M. Joubert, on the sulpho-carbonates as a remedy for the phylloxera. He gives 145 grains per square yard of surface as the amount to be applied for this insect. These proportions would not do

to apply for the grasshopper, as it would cost more than the land is worth in many cases. If the sulpho-carbonate of potassium has the same effect on the eggs of the grasshopper as it has on the eggs of the potato bug, it would certainly be well worth trying.

I hope some one who may have the opportunity of trying this remedy will do so and report the result. The sulpho-carbonate which I used is known in the market as the sulphide of potassium.

Philadelphia, Pa.

WM. L. BILLIN.

Steam Cars vs. Horses.

To the Editor of the Scientific American:

An experiment was made in Philadelphia, a few days ago, to show the possibility of superseding horses by steam on their railways. The seven cars used in this trial present nothing different in their general plan from that of the most successful ones which have been many times tried and are now in use in some other localities, except perhaps the application of steam to the brakes for sudden stops.

Steam seems destined to complete its mission to man through the media of piston and crank. These simple devices will probably never be superseded as a means of transmitting the force of steam to a driving wheel. The only thing now to be done is to give to the steam car the best material, the best proportion, the best of workmanship, and a level track to work upon, and its complete success will be assured. No grade should exceed twenty feet per mile; it is far better to go three or four miles round than to go half a mile over a hill at a much steeper grade than this. Six of the cars are inside-connected, and have 5½ inch pistons and 7 inch cranks; the other is outside-connected, and has 8 inch pistons and 5 inch cranks. This last is far the best arrangement for hard work. Less area of pistons and longer cranks would be preferable, however, and 5½ inch pistons and 10 inch cranks would be quite as efficient and would impose far less strain upon the bearings, and hence would be more durable. The bodies of the cars are about twenty feet long, five feet of which, at one end, is used for the boiler and engineer, the machinery being placed horizontally under the floor. Now that we have excellent steel plate for boilers, and have learnt to exactly match the rivet holes by drilling, and to rivet by machinery, there can be no reason why a steam car should not be made, with all of our improved appliances and experience, to run twenty years at an expense for repairs of less than twenty dollars a year.

The most formidable bars to the success of steam cars are steep grades. It requires only about 8 lbs. to draw a ton on level rails, while the ascent of a 20 feet grade requires about double this amount; and the ascent of a 160 feet grade, like that upon the Worcester and Shrewsbury road, requires about nine times this amount. To figure this out, we have only to divide the number of feet in a mile by the number of feet rise per mile, and then divide the number of lbs. in a ton by the quotient. The last quotient, plus 8, denotes the number of lbs. required to draw a ton up the grade. Thus: $\frac{5280}{160} = 33$, then $33 + 8 = 41$, then $41 \times 8 = 328$ lbs. to draw a ton up a 160 feet grade.

Worcester, Mass.

F. G. WOODWARD.

The Russian and Turkish Navies.

The present war between Russia and Turkey is likely to bring about the one event which is needed crucially to test the efficacy of modern armored vessels, that is, their opposition in actual combat. All the building of ironclads, and the constant improvements in their armor due to the increase in power of heavy guns, which have been going on for the past fifteen years, fairly may be regarded as accomplished under conditions embodying a constant element of uncertainty; and this for the reason that the always varying circumstances under which vessels may enter into conflict cannot be foreseen or provided for. Leaving out of consideration the skirmishes which occurred on the coast of Spain during the civil war in that country, none of the European ironclads have ever (with the exception of a single instance) been in action. This exception was the quickly decided fight between the Austrians and Italians, in which twelve Italian armored vessels and eight wooden vessels met the seven armored and fifteen wooden vessels constituting the Austrian fleet. The Italian flagship *Ré d'Italia*, a wooden ironclad, was rammed and sunk by the Austrian flagship *Ferdinand Max*; and the Italian corvette *Palestro* was blown up. The Italians exhibited extraordinarily bad gunnery, and the Austrians won an easy victory. This battle, however, furnishes no useful lesson, unless it is to show how difficult it is to manœuvre a ship so as to render her ram effective against an enemy who manœuvres equally well to get out of the way; for the Austrian could not ram the *Ré d'Italia* until the latter had had her rudder disabled. The conflict mainly, however, is an instance in point, exemplifying the fact that the conditions determining success in battle are not to be gained by providing a preponderance of ironclads in one opposing fleet; nor can the fortunes or misfortunes of vessels be invariably provided for by the skill of the naval constructor.

The two fleets which are soon to serve as targets for each other, and thus, at the cost of much blood and money, to furnish data of inestimable value to the war-shipbuilder of the future, are quite evenly matched, as far as ironclads are concerned. Russia has 29 armored ships, and 196 other vessels of all classes, carrying altogether 521 guns; 27 of the first mentioned vessels are in the Baltic, and 2 are in the Black Sea. Of these, the recent report of Chief Engineer

J. W. King, U.S.N., on European ships of war, whence we take our facts, says that but two, the *Peter the Great* and the *Minin*, approach the modern standard of fighting efficiency. The *Peter the Great's* armor is 14 inches in thickness, with iron hollow stringers on the backing besides, which are alleged to give an additional resistance equal to 2 inches of iron. The four guns, two in each of the turrets, are steel breech-loading guns on the Broadwell system, of 12 inches caliber. She has no ram. Her length is 321 feet, breadth 64 feet; displacement 9,510 tons. She has twin screws, and a maximum speed of 13 knots. The *Minin* is 298 feet long and 49 feet broad, and displaces 5,650 tons. She carries four 11 inch guns, and 12 inches of armor on 24 inch backing. She is a rigged turret ship on the Coles system, but is undergoing alterations which will place her guns on two turntables on the main deck, so that they fire *en barbette* over the top of the battery. Next in importance are the broadside vessels *Duke of Edinburgh* and *General Admiral*. These are of iron, wood-sheathed, and displace 4,438 tons each. Their armor is disposed in a belt over the vital parts, and is 6 inches thick by 7 feet wide. Their speed is 13 knots, and armament four 8 inch rifled and two 6 inch chase guns. Next in the sea-going fleet are four ships named after admirals, two carrying each six guns in three turrets, and two each four guns in two turrets. The caliber of the guns is but 9 inches, and the armor but 6 inches thick. Two wooden armored frigates follow, which carry large batteries of small guns and thin armor. They may be regarded as obsolete. For coast defence, Russia has the circular ironclads which we have so frequently referred to, but the efficacy of which is, to say the least, doubtful. One has two 11 inch, the other two 12 inch, guns; and the thickness of armor is respectively 11 and 18 inches. There are ten single turret monitors of the early Ericsson pattern, and the three two-turret monitors carrying 10, 8, and 9 inch guns, and having armor not exceeding 5 inches.

As against this fleet Turkey can make the following exhibit: The *Mesoudiyeh* and *Memdoohiyeh* have recently been completed in England. The first has already been delivered to the Sultan, the second completed her trial trips in January last. The displacement of these ships is 9,000 tons each, length 332 feet, and beam 59 feet. They are full-rigged frigates of the broadside central battery type, with hulls of the usual cellular construction, there being in all 82 watertight compartments. The battery is 153 feet in length, and the armor plating on the sides is 12 inches thick, backed by the same thickness of East Indian teak. The armaments are twelve 18 ton and two 6½ ton Armstrong guns. The maximum speed is 13.8 knots. Five ironclads follow, each nearly 300 feet in length and carrying 10 inches (in one case 9 inches) of armor plating. The armament of four is fifteen 6½ ton guns and one 12 ton gun; the fifth has ten 12½ ton, two 6½ ton, and 6 small, guns. Seven ordinary station service ships follow, four with armor ranging from 9 to 7 inches in thickness, and carrying each four 12 ton guns, three with armor from 4½ to 4 inches carry five 150 pounders and one 12 ton gun. Lastly come five gunboats, each carrying two 12 ton guns and 3 inches of armor, and two coast defence monitors. In all, Turkey has 24 armored fighting ships, nearly all new. She has few wooden seagoing cruisers, and therefore it is probable that no naval combats will occur elsewhere than in the vicinity of the immediate seat of war, and most likely in the Black Sea.

The Fall of the New York Post Office Roof.

The falling of a portion of the roof of the Post Office Building in this city recently killed three men, and wounded several others who were at work in a room beneath. The Acting Supervising Architect, Mr. James G. Hill, says that the roof was from 50 to 75 per cent heavier than it should have been. It carried five inches of concrete and cement at the crown of the arches, and a thickness of fourteen inches of the same materials at the deepest part, over the nine inch rolled beams. Some time ago, a portion of a brick wall, which aided in supporting the weight of the roof, was removed, and in lieu thereof a Howe truss girder was substituted. This gave way, and appears to have slipped from its inner bearing on the interior wall, and also to have brought down the plate and purlin by which the outer end was sustained. The purlin seems to be badly wrenched; but as yet it is not definitely determined where the structure first failed.

It is generally conceded that the Post Office Building, though imposing in general appearance, is of inferior architectural merit; but it has always been supposed that, as an edifice, it was exceptionally solid and strong. The Coroner has impaneled a jury of prominent architects, and the thorough investigation which the structure will receive at their hands will doubtless bring out the true facts in regard to it.

A very general reduction of wages is in progress among the miners and blast furnacemen of Scotland. In a number of instances the men are already working on the reduction, and in a week or two the notices will take effect at other works. As a rule, the reduction amounts to 6d. per day, which brings down the wages to a very low level. In one district it is said that the wages, even for six days' work, will not exceed \$4.50, gold, per week, when the off-takes are deducted from the gross earnings.—*Engineering*.

The address of Mr. H. R. Houghton, whose fire escape we illustrated in our last issue, is 59 West 42d street, New York city.

HOW TO DO IT, AND HOW NOT TO DO IT.

In walking through a workshop the eye of the ordinary observer will almost invariably lead him to form a tolerably accurate estimate of the capabilities of at least a large proportion of the workmen; and especially is this the case in a large shop, where the men can scarcely be so carefully selected as in small establishments, when their numbers are comparatively limited. There is something in the attitude, the interest taken in his work, the energy or delicacy, as the case may be, with which the expert workman handles his tools, which points him out as plainly as the awkwardness, indifference, or abstraction indicates his opposite; and what that something is the pen of our artist has delineated far more plainly than words can express. Take, for example, the figure represented in "How to Do It" in the act of rough chipping, and it is observable at a glance that his mind as well as his muscle are concentrated upon his work. We are very apt to cast a pleasant glamour upon the past; and this it is which causes each successive generation to look back, perhaps with regret, to the good old times; and to those who highly value mechanical skill, the days of the hammer and chisel were good old times indeed. The workman of the special machine workshop of these days would be altogether surprised to see the large amount of good and accurate work which expert old mechanics can perform with the hammer, chisel, and file. There are, indeed, workmen still extant who would have no hesitation in undertaking to equal in quality and surpass in quantity, upon some kinds of work, the capabilities of the ordinary vise hand even with the assistance of a modern planer and shaper. Among this class of work the fitting in of brasses into ordinary pillow blocks may be instanced. And although, as we have said, the hand workman of the good old times is not altogether extinct, he is not to be found in special machine shops, and may be looked for in repair shops, where he commands nearly one third more than the average machinist's wages.

In the illustration under the heading of "How Not to Do It," our artist has represented not only errors in the method of manipulation, but also the want of interest in the work which is at times met with in large shops among the operatives; while in "How to Do It," he has shown the proper attitude for the workman performing the several operations, and has given him, in each, the look of a zealous and painstaking artisan.

The chipping hammer is not by any means the rude instrument which it appears to the uninitiated; and there are as many styles of using it as there are in the use of the pen. For heavy duty, it should be held near the end of the handle. The arm should swing freely, the hand never traveling further backwards than a line vertical to the operator's shoulder. The movement should be obtained partly from the elbow, partly from the shoulder, partly from the body itself, and (in a minor degree) from the wrist. If then we turn to the figure "Rough Chipping," in "How Not to Do It," we perceive that, with the hammer held as there shown, these movements would be difficult, and would cause a constrained ac-

tion of the body and arm. The chisel should be held close to its head, gripped tight, and pressed firmly against its cut.

For fine chipping—that is to say, for the finishing cut—the chisel is held in the same manner; the hammer is grasped nearer to the middle of the handle, and the blows are comparatively light. Under such circumstances, the cut may be so smoothly taken that the finger applied over a length of, say, two inches, without the assistance of the eye, will fail to detect if the work has been chipped or filed. Both these operations require strict attention; and though apparently rude, they are actually delicate if skillfully performed.

In contrasting the two illustrations of rough filing, the practised eye would readily detect the improper manipulation, irrespective of the want of attention, shown in the one figure. The distance of the operator from his work would alone expose his unskillfulness. To properly use a rough file, it should be held so that the file handle presses against the palm of the hand, and hence so that the strain due to pushing the file will be in a line with the length of the arm from the hand to the elbow. The operator should stand well off from the vise, and must drive the file by a motion of the body almost as great as that of the arms. In this way, the weight of the body will be placed upon the file to such an extent that the heel of the operator's forward foot will lift from the floor, as shown in our illustration, the fulcrum for the pushing duty being the rear foot. During the return stroke of the file, the forward or left foot comes into play as a fulcrum, by which the operator's body recovers its former position; and it also enables the arms to relieve the file of pressure during its back stroke. The motion of the file during this latter stroke should be much quicker than during the forward motion. The file is a wonderful tool in skillful hands, capable, indeed, of producing work more truly smooth and accurate than any other known cutting tool, the lathe tool not excepted. Its use, indeed, in the finishing processes is mainly to correct the inaccuracies which are inherent to work produced by other cutting tools, especially upon plane surfaces; and it is an inexorable fact that we have at this day no machine or tool capable of producing flat metal surfaces as small, even as six inches square, so true that a judicious application of the file will not at least double the contacting area of two such pieces placed together.

Draw filing is a method of using the file which answers two purposes: the first to leave the file marks in the most desirable direction, and the second to touch only such parts of the work as require operating upon to secure truth and accuracy of dimensions. Having rough and smooth crossfiled the work down to such a size that the drawfiling will entirely erase the crossfile marks (for filing in the position shown under the heading of rough filing is called crossfiling, whether the file be a rough, second cut, or smooth file), the operator tests his work to discover the protruding spots or places. He then casts his eye along the length of the file, holding the latter edgewise to the eye, first to ascertain the curve or sweep of the face of the file, and secondly, to select a part of the file where that curve is the greatest and most

regular. Then turning the file over, he brings the selected part of the file to bear upon the protruding part of the work, and uses the file as shown in our illustration, watching intently every mark made by the file teeth, so as to insure that the cutting duty is being performed exactly in the required spot, and that the surrounding surface is not being operated upon. If the surface of the work has been drawfiled all over, and it becomes difficult to distinguish the file marks being made, he gives the file a slight lateral movement (first to one side and then to the other) as well as a reciprocating one, so that the new file marks distinguish themselves by slightly crossing the old ones. It is in drawfiling that the utmost skill is to be shown; and here we may caution the operator against an error that he is very apt to fall into. This error is in taking long strokes in drawfiling; because in such case the filings are apt to clog in the file teeth, producing what are technically termed "pins," that is, small pieces of iron which stick fast to the file and cut scratches in the work, entailing a large amount of extra work to file such scratches out. It is obvious that the brains must not be wool-gathering when drawfiling is under operation; for good judgment, strict attention, careful manipulation, and perfect confidence must be combined to produce good work. An error in selecting the part of the file to be used, or an error in applying that exact spot to the requisite place in the work, will produce a hollow spot in the work, which, if the latter is down to its proper size, can never be remedied; while want of judgment as to the quantity of metal requiring to be removed will cause either a badly finished job or else consume more time in testing the work than in filing it. Apropos of this latter fact, a well known master mechanic related to us the other day a piece of advice once given by a skillful workman, A, to an artisan, B, who, though a very industrious, painstaking man, was, from lack of experience, somewhat the reverse. A had employed B to work for him by the piece; and giving him a locomotive guide bar to file up, he first told him to test the bar. Then, giving him a rough file, he said: "Now file off as much as you think is necessary, and don't be afraid of it; when you have done so, come and tell me." B set to work with a will; and in a quarter of an hour he came to A, saying that he had filed off what he considered ample. "Go back to your vise," said A, "and file off just as much more." "But—" said B. "There are no 'buts' in the case," said A; "do exactly as I tell you." B set doggedly to work, and obeyed orders; and on testing the job, it required a little more filing in the same places. "This," said our visiting master mechanic, "was a lesson I never forgot and have often remembered to my advantage." The moral here pointed is founded upon a fact which any one who watches the manipulation of vise hands (upon all but very small work) will speedily observe, namely, that, for lack of cultivating the judgment, it often takes more time to try and retry the work than it does to file it. Fitting journal brasses, keys, dies, and sliding blocks, and filing very true flat surfaces, may be instanced as classes of work in which this is liable to occur.



HOW TO DO IT, AND HOW NOT TO DO IT.

IMPROVED HIGH SPEED DRY AIR COMPRESSOR.

We illustrate herewith a new and very compact form of air compressor, designed for obtaining any desired pressure per square inch for driving rock drills, transmitting messages, forcing sand blasts, and, in general, all pneumatic purposes. The perspective view, Fig. 1, shows the engine side of the machine; Fig. 2 represents a section of the compressing cylinders. Motion is imparted to a forked rod which is attached to the center, *g*, of the plunger pistons, *J*, in such a way that facility is afforded for the adjustment of said pistons relatively to the discharge valves of the compressor in order to meet disturbances consequent on wear and for tightening up the driving connections.

It will be observed from the section, Fig. 2, that there is in reality but one piston, each end of which works in a separate compression cylinder. Each end is tightly packed; and in each end face is a valve, the stem of which is surrounded by a coiled spring, *I*. At the compressing end of each cylinder is an enlargement, *H*, formed by the extension of the cylinder. This is constructed to form a seat for the outlet valve, *G*, which is held up to the shoulder by the spring, *e*, which surrounds its stem. At *d* is the air outlet.

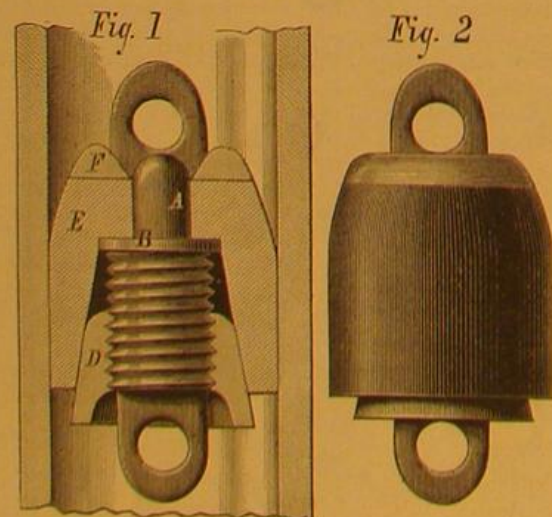
When the piston makes an inward stroke, its valve, *I*, of course closes, and the air is compressed before the piston and against the valve, *G*. As soon as the pressure on the latter exceeds the oppositely acting pressure of its spring, the valve opens; and the compressed air then escapes through the outlet, *d*. As soon, however, as the pressure is sufficiently reduced, the valve spring reacts; and as the piston at the end of its path projects for about $\frac{1}{4}$ inch into the enlarged portion, the valve comes back directly against it and follows it until once more forming a flush joint with the shoulder. Meanwhile the valve in the piston opens, and air enters between the same and the valve, the piston continuing its rearward stroke until past the orifice, *f*, which opens directly into the air, and thus a full supply is insured, ahead of the piston, before it begins another compressing stroke. Of course the reverse operation is going on in the opposite cylinder; and in this way the action is rendered continuous.

It will also be noticed that there is not only an absence of ports and passages, but that no water whatever is used in the air cylinder; so that the danger of wear from gritty particles in the same is entirely obviated. The water necessary for cooling is applied only on the outside in the jacket, *C*. Any kind of water may be used without injury to the compressor. As the areas of opening in the inlet and outlet valves are very large, they require but a slight motion to admit or release the air, consequently the machines may be run at a high rate of speed, from 175 to 200 revolutions, and are made light in weight when compared with the amount of work they are capable of performing.

For further particulars, address the manufacturers, Messrs. Guild & Garrison, 34 to 44 First street, Brooklyn, E.D., N.Y.

KENYON'S ADJUSTABLE RUBBER BUCKET FOR CHAIN PUMPS.

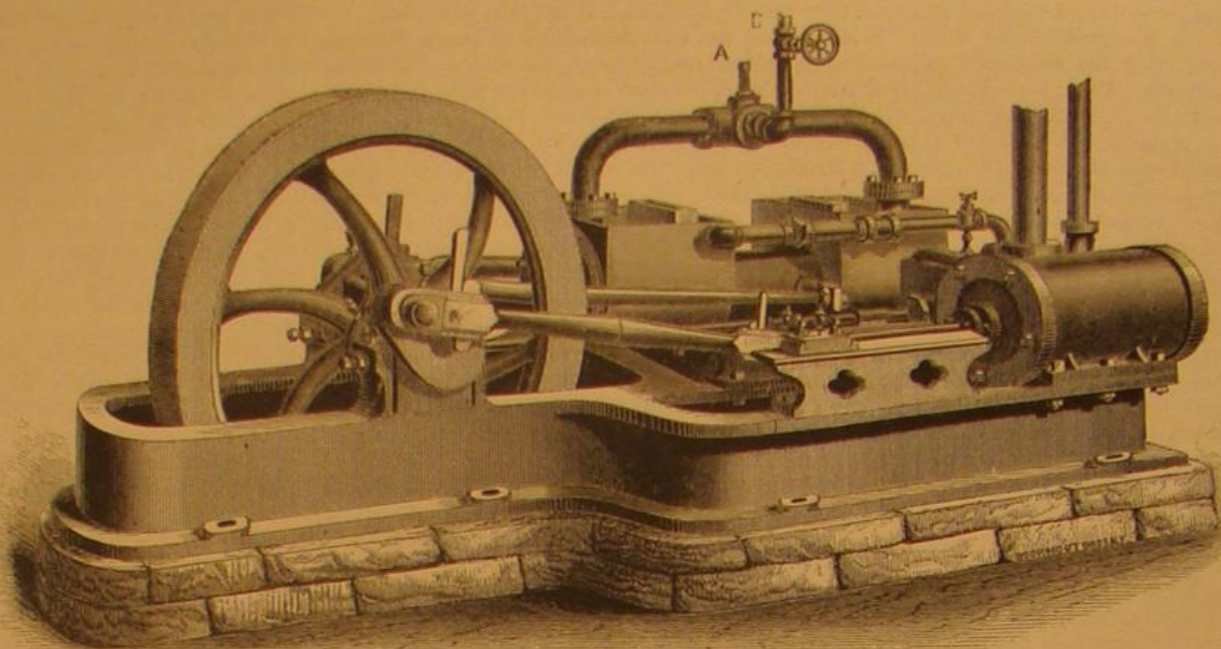
The annexed engraving represents a new rubber bucket for chain pumps, which may be adjusted so as to accurately



fit the tube, and also so as to take up wear. It acts both as a suction and forcing piston, and is claimed to raise water from deep wells at a small expenditure of power. Fig. 1

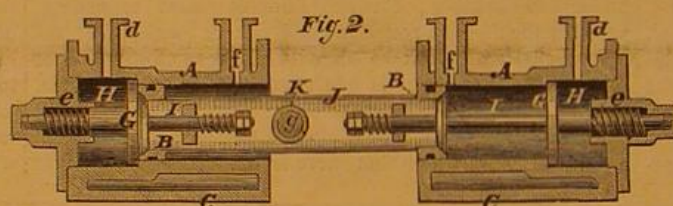
represents an exterior view, and Fig. 2 a sectional view of the device.

The link, *A*, is provided with an eye at each end, for attachment to the chain; and on its upper portion is formed a collar, *B*, which receives and sustains the downward pressure of the columns of water, and thus prevents the said pressure forcing the rubber downward and expanding the same. On the link and below the collar is a screw thread, on which moves the cone, *D*. *E* is a rubber packing, which



GUILD & GARRISON'S AIR COMPRESSOR.—Fig. 1.

can be expanded outward to fit the pump tube by moving the cone, *D*, inward; or it may be adjusted so as to enter a smaller tube by moving said cone in the reverse direction. A metal washer, *F*, is placed on top of the rubber packing, and prevents the same from being forced out of place by the cone, *D*. This washer has a longitudinal slot, whereby it may be slipped over the link eye. It is then rotated a quarter turn, so that it cannot come off; while the pressure of the rubber prevents its turning backward. The cone, *D*, is easily moved by grasping the rubber packing in one hand



and turning the link, *A*, by means of a wrench held in the other.

Patented April 17, 1877, through the Scientific American Patent Agency. For further particulars, address the inventor, Mr. Thomas Kenyon, P. O. box 103, Hamilton, Butler county, Ohio.

Marvels of Man.

While the gastric juice has a mild, bland, sweetish taste, it possesses the power of dissolving the hardest food that can be swallowed; it has no influence whatever on the soft and delicate fibers of the living stomach, nor upon the living hand, but, at the moment of death, it begins to eat them away with the power of the strongest acids.

There is dust on sea, on land; in the valley, and on the mountain top; there is dust always and everywhere; the atmosphere is full of it; it penetrates the noisome dungeon, and visits the deepest, darkest caves of the earth; no palace door can shut it out, no drawer so secret as to escape its presence; every breath of wind dashes it upon the open eye, and yet that eye is not blinded, because there is a fountain of the blandest fluid in Nature incessantly emptying itself under the eyelid, which spreads it over the surface of the ball at every winking, and washes every atom of dust away. But this liquid, so mild, and so well adapted to the eye itself, has some acidity, which, under certain circumstances, becomes so decided as to be scalding to the skin, and would rot away the eyelids were it not that along the edges of them there are little oil manufactories, which spread over their surface a coating, as impervious to the liquids necessary for keeping the eyeball washed clean as the best varnish is impervious to water.

The breath which leaves the lungs has been so perfectly divested of its life-giving properties that to rebreathe it, unmixed with other air, the moment it escapes from the mouth, would cause immediate death by suffocation; while if it hovered about us, a more or less destructive influence over health and life would be occasioned; but it is made of a nature so much lighter than the common air that the instant it escapes the lips and nostrils it ascends to the higher regions, above the breathing point, there to be rectified, renovated, and sent back again, replete with purity and life. How rapidly it ascends is beautifully exhibited every frosty morning.

But foul and deadly as the expired air is, Nature, wisely economical in all her works and ways, turns it to good account in its outward passage through the organs of voice, and makes of it the whisper of love, the soft words of affection, the tender tones of human sympathy, the sweetest strains of ravishing music, the persuasive eloquence of the finished orator.

If a well made man be extended on the ground, his arm at right angles with the body, a circle, making the navel its center, will just take in the head, the finger ends, and feet.

The distance from top to toe is precisely the same as that between the tips of the fingers when the arms are extended.

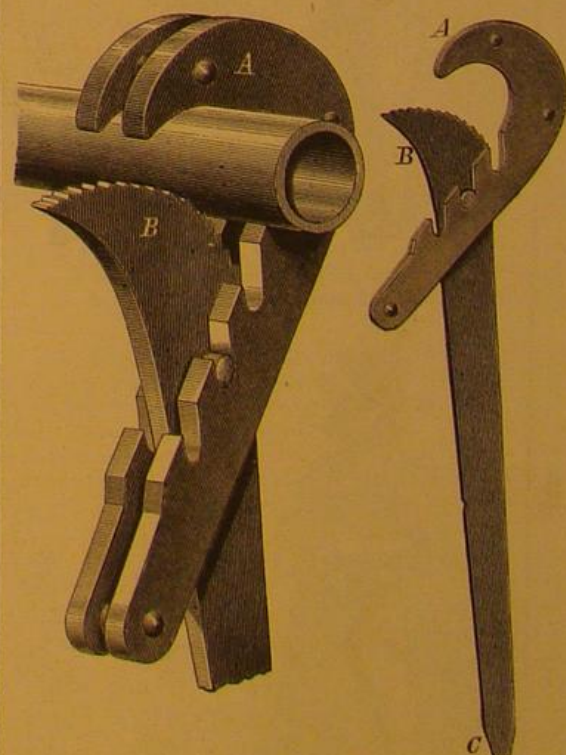
The length of the body is just six times that of the foot; while the distance from the edge of the hair on the forehead to the end of the chin is one tenth the length of the whole stature.

Of the sixty-two primary elements known in Nature, only eighteen are found in the human body, and of these, seven are metallic. Iron is found in the blood, phosphorus in the brain; limestone in the bile; lime in the bones; dust and ashes in all! Not only these eighteen human elements, but the whole sixty-two, of which the universe is made, have their

essential basis in the four substances, oxygen, hydrogen, nitrogen, and carbon, representing the more familiar names of fire, water, saltpeter, and charcoal; and such is man, the lord of earth! a spark of fire, a drop of water, a grain of gunpowder, an atom of charcoal!—*Hall's Journal of Health.*

COMBINED PIPE TONGS, WRENCH, AND SCREWDRIVER.

The annexed engraving represents one of those useful tools which combine in themselves the capabilities of a number of constantly needed implements, and thus reduce both the cost and the bulk of the mechanic's working kit. At the same time, tools of this description are always handy to have about the house or the farm; as they afford a means of quickly doing many a little job of timely repairing, which may save more difficult work in the future. The present device is a combination of pipe tongs, wrench, and screwdriver, which implements the gas or steam fitter constantly requires. *A* is a double jaw or clamp, curved at one end to extend around the pipe or nut, as shown, and which has its parts laterally connected by stay pins. On the longitudinal portion of this jaw are notches which receive the pivot pin of the single jaw, *B*, which enters between the parts of jaw, *A*, and has an eccentrically shaped clamping end, which is serrated so as firmly to bind upon the object grasped. The lower end, *C*, of the shank of jaw, *B*, is tapered to form a screwdriver. When this portion is in use, the single jaw is drawn out, and the double jaw is reversed to form a handle.



Patent pending through the Scientific American Patent Agency. For further particulars, and for tools, address the inventors, Messrs. States & Cook, Topeka, Kansas.

A REMARKABLE KINGFISHER.

There are over fifty species of the *halcyonidae* or kingfishers; but none is more remarkable than the one shown in our illustration. From its peculiar screaming laugh, not unlike the bray of a donkey, it has obtained the name of "the laughing jackass." Its zoological name is *dacelo*, one species, *d. gigas*, being a large bird, 18 inches long, and endowed with strength and courage; it feeds indiscriminately on any animals of suitable size, whether quadruped, bird, reptile, fish, insect, or crustacean. It is a handsome bird, being brightly colored; and its flight is quick and noiseless. Its powerful bill makes it a very formidable enemy.

The *Illustrated News*, of Adelaide, Australia, from whose pages we select the engraving, gives the following particulars of this interesting bird: "The laughing jackass is almost too well known to need description. His appearance and extraordinary note are familiar to the inhabitants of every country village. Indeed, he frequently extends his researches into the neighborhood of towns, occasionally taking up his abode for life in some healthy suburb, and punctually entertaining the inhabitants thereof, morning and evening, with a succession of those singular sounds which have rendered his name famous. Although a kingfisher, he never procures his food from the water, after the orthodox fashion of kingfishers, but has more the habits of a bird of prey. Sitting motionless among the lower branches of some tall gum tree unnoticed, and apparently half asleep, he waits, like Micawber, for something to turn up. Suddenly, without noise, he drops off his bough and flies direct to a certain spot, whence he soon returns, bearing in his beak a lizard, a small snake, or perhaps a rat. His acuteness of sight is extraordinary. From his elevated post he seems to miss nothing, and discerns his prey in swamps and crevices of rocks at a distance that is perfectly astounding. The laughing jackass has the advantage of being able to live on almost anything that presents itself; hence it is always in good condition, and apparently in good humor. It seems, indeed, to pass its life in self-congratulations; and when four or five meet and unite their voices, and they invariably do, morning and evening, the noise would suggest the idea that a party of demons had broken loose and were rejoicing over some piece of successful mischief. But in spite of his careless, happy life, the laughing jackass has his peculiar duty, and he performs it conscientiously. Snake killing is his specialty; lizards, frogs, beetles, small birds, rats, etc., are his usual food. In fact, nothing comes amiss to him; let a snake appear upon the scene, and the laughing jackass recognizes his quarry at once. Never hesitating, he makes straight for it, his agitation being observable by the quivering crest feathers. With some caution, he swoops backwards and forwards, seeking an opportunity to seize the reptile. The snake, with head erect, ready to strike, keeps on the alert. The excitement continues for some time till the bird finally settles down, close by, on the ground. But all his stolid heavy appearance is gone. His wings and tail quiver with agitation and eagerness. Fully alive to the dangerous character of his opponent, he keeps at a safe distance. Flitting round, his head just out of reach, he continues to annoy him, till becoming exhausted, the snake affords him the opportunity he is seeking. With the rapidity of lightning the bird descends upon his prey, then rises in the air, bearing with him the captured snake, neatly held just behind the head, in such a position as to render him perfectly powerless. Rising until he has attained a considerable height, he directs his flight to a more open part of the country, then suddenly backing in the air, he drops the reptile, following it down and reaching the ground almost at the same time. Stunned and bruised, the unfortunate snake is in no condition to renew the contest, and is very soon despatched and eaten by his victorious enemy."

The Secretary Bird.

A curious experiment took place the other day at the Jardin d'Acclimation in Paris. A nest of living vipers was thrown into the inclosure where the secretaries or snake-eat-

ers (from the Cape) are kept. These birds have the bright eye of birds of prey, powerful beaks, and vulture-like bodies mounted on legs like those of a wading bird. Whenever the secretaries saw the snakes they fell upon them with shrill cries, and an exciting struggle ensued. The reptiles fixed on the ground by the strong feet of the bird, twisted and hissed, and bit; but they could make no impression on the rugose skin, and they were chopped into mincemeat with a few strokes of the beak. The secretary is also, it may be remarked, a great destroyer of rodents.

Scarcity of Tanning Materials in Great Britain.

The scarcity of the vegetable products principally used in tanning has become so serious that the Tanners' Society of Bristol has officially brought the matter under the notice of the Council of the Linnean Society, in the hope that they may encourage a search by travelers for other plants having similar properties, or stimulate the cultivation of known ones. The supply of valonia from Surzema and Greece is this year very small; and as this is one of the most impor-



THE LAUGHING JACKASS OF AUSTRALIA.

tant tanning agents, much inconvenience has been experienced, and the trade has been compelled to seek other materials. Two new plants have been brought to market, but in such small quantities as to be of little use; but if their growth could be encouraged they would be very valuable. One is a small gall from the tamarix, growing in Morocco and also in India. It yields about forty per cent of tannin, which is of remarkably fine quality, and is at present used almost entirely for medicinal purposes. The other is the seed and pod of a kind of bean called *balsamo carpon*, and yields a tanning gum of great strength. It grows in mountainous districts in Chili. The seedpods are very soluble in water, and would need to be grown in a country where little rain falls.

To Cleanse the Woodwork Around Doors.

Take a pail of hot water; throw in two tablespoonfuls of pulverized borax; use a good coarse house cloth—an old coarse towel does splendidly—and wash the painting; do not use a brush; when washing places that are extra yellow are stained, soap the cloth; then sprinkle it with the dry powdered borax, and rub the places well, using plenty of rinsing water; by washing the woodwork in this way you will not remove the paint, and the borax will soften and make the hands white—a fact well worth knowing. The uses of borax in domestic economy are numerous; and one of the most valuable is its employment to aid the detergent properties of soap.

Underground Telegraphs.

The two valuable practical papers, "Underground Telegraphs," by Mr. Willoughby Smith, and "Underground Telegraphs in France," by Mr. John Aymer, C.E., of Paris—which were read before the Society of Telegraph Engineers at their last meeting, on the 28th ult., has served to bring again into prominence the subject of covered telegraph lines.

Taking up a statement of Mr. Prescott's which appeared in the *American Journal of the Telegraph* some six or eight months ago, that the "use of underground telegraph lines had thus far been attended with very unsatisfactory results," Mr. Willoughby Smith sought to establish, and undoubtedly succeeded in establishing, the fact that underground telegraph lines need be attended with no greater risks than open lines—nay that, were the proper material only employed, and due care taken in the execution of the work, there is no reason why covered lines should not be made as safe and durable as need be desired. The most interesting feature, however, of Mr. Willoughby Smith's communication was the argument which he brought forward against the employment of tar on gutta percha covered wire. A covering of tarred tape is, as is well known, all but universally adopted at present as the final protective covering. This, it is alleged, is a grave mistake; for by reason of its use the insulation resistance is materially diminished, and the germs of decay, which in time lead to the complete destruction of the coating, are implanted in the gutta percha. The tar ought to be abandoned, and in its place tannin, whose employment was stated to have been highly satisfactory, ought to be adopted. In the valuable address delivered some time since by Professor Abel, at the Society's opening meeting, this same subject was dealt with, and the state of our knowledge with reference to the causes of decay in gutta percha was shown to be crude in the extreme.

Granting, however, that tar is an objectionable feature in the manufacture of gutta percha covered wire, was there not some point in what was remarked, by one of the speakers in the animated discussion which followed, that surely then Chatterton's compound was not altogether an unmixed advantage? Chatterton's compound consists of one part of Stockholm tar to one of resin and three of gutta percha, and has long been regarded as the panacea for every evil that could befall gutta percha covered wires. No coating can be considered complete, it is said, no wires can be welded homogeneously together, without Chatterton's compound; and if tar is the *bête noir* it is now stated to be, what becomes of the influence of Chatterton's compound? It is all very well to be told, as Mr. Willoughby Smith told us the other evening, that "in the compound the sting of the tar was taken out." It is a pity that the same process of sting-abstraction could not be applied with equal success to the tar in the tape. No, we shall wait for a few further data and a few additional experiments before condemning the tar wholesale and making it accountable for all the mischief; and we will be content to look for the deterioration of the gutta percha, to a very great extent at least, in the cheap and consequently indifferent material which has never been properly tested, and hasty manufacture over which no efficient check has yet been introduced.

No one will now attempt to call in question the possibility of manufacturing really good covered wires; the battle of india rubber and gutta percha need not be fought over again, for the improvements effected in the latter have been so decided of recent years that its position is well-nigh unassailable by its old rival. If danger is to be anticipated from any quarter, paraffin and the products of paraffin will probably show it the most dangerous front. Meanwhile, every one will admit that covered wires as good as need be looked for in the existing state of our knowledge can without difficulty be manufactured, and no one will deny that their laying is a matter which requires nothing more than care to be attended with success. When, therefore, the need for underground telegraphs on a more extended scale than at present does arise, either from the crowded state of the open lines on every

available route, or from an alternative channel being thought desirable, we may rest perfectly satisfied that our telegraph engineers and electricians will be quite equal to the occasion; and if the day when that need does arise is even but a short way off, they may as likely as not turn round and regard our manner of doing things in much the same light as we regard the now antiquated attempts of but a few years back in the matter of covered lines.—*London Telegraphic Journal.*

Care of Horses' Feet.

When the foot is gone, there is no horse left. There is an old adage to this effect, the truth of which is incontrovertible. Yet no part of a horse's anatomy is worse used than the foot, and there are no more frequent diseases to which the notice of the veterinary surgeon is brought than those of the feet. This comes of the unwise yet obstinately maintained fashion of rasping, cutting, burning, tarring, and greasing the hoofs. It would occupy too much space here to describe the anatomy of the foot fully, but it is a very timely matter just now to consider the structure of the horny outer covering or crust of the foot, by which the delicate inner parts are protected.

Horn is a fibrous substance, which contains twenty-five per cent of water. The fact that it contains water in its normal composition is a very important one, and needs to be stated here, because, unless specific reasons are given, very little weight is generally accorded to all that may be written or said about the proper treatment of the horse's foot, by either horse owners, farmers, blacksmiths, or professional horseshoers. When horn is deprived of water it becomes dry, hard, and without elasticity, precisely like a piece of dry glue, which breaks and splinters into glassy fragments. It is necessary, therefore, that this water should be retained, to keep the horn in good condition. The common practices of burning the sole to procure a fit for the shoe, or rasping the outer surface to get a good shape, and of tarring and greasing the hoof, all tend to drive the water out of the horn, and not only to harden and contract it, but to make it brittle. In this condition its usefulness as a protection for the foot is at once impaired and partially destroyed. When the sole is burned by contact with a hot shoe, it is obvious that the water in the portion of the horn that is heated must be driven off. That is so obvious that no more need be said about it. When the smooth, polished, hard surface of the horn is rasped away, the softer inner fibrous portion is exposed to all the evil influences of evaporation and degradation, and the numberless pores and cells or interstices of the horn are enabled to give up the water they contain. The horn in this case is also made dry and brittle, and, of course, contracts. Tar contains an acid and a volatile oil, which evaporates and leaves a hardened pitchy mass. When tar is applied to a hoof the acid acts chemically upon the horn, and hardens or disintegrates it, and the oil, evaporating, leaves a space between the fibers filled with the hardened residue. It operates precisely in the same manner as when it is applied to leather—as a sole of a shoe, for instance—as a preservative: the leather in a few days becoming hard and unyielding, impervious to moisture, and dry. As with tar, so with grease; both these substances drive out the water from the horn and occupy its place, in time hardening and acidifying the substance of the hoof crust, rendering it brittle, and contracting it.

The substance of the frog is horn, but is of a softer and more open texture than the sole and crust of the hoof. It is, therefore, more easily affected by injurious conditions, and when it becomes deprived of its water it shrinks more than the more solid horn. From this explanation of the character of the horny covering of the foot any reasonable horse owner may learn how to treat the hoof, and how to avoid injuring it. When a shoe is to be fitted, the edge or wall sole should be prepared by cutting or rasping, and not by burning. Indeed the shoe should be fitted to the foot, and not the foot to the shoe. When, from bad management, the sole and frog have become dry and contracted, no grease or tar should be used; but water should be used freely, and then the hoof should be dressed with glycerin, which will mix with water, and does not displace it. Glycerin contains no acid or acrid properties, but is soft, bland, emollient, and does not evaporate. It therefore softens the horn, and allows the fibers to expand. Contraction is thus prevented, or overcome when it has actually occurred.—*New York Times.*

Culture of the Memory.

The student lamenting his lack of ability to remember his lessons, and, jealous of another who spends only half the time which he employs in their preparation, sees that his rival's memory always serves him in the recitation room, may take encouragement from the following, condensed from the *Philadelphia Public Ledger*:

It is a common idea that a good memory is a ready-made gift, which Nature whimsically confers upon some and withholds from others.

Now, the truth is that the memory is a faculty which, as much as any other, needs development. Its capacity is doubtless greater in some than in others by natural endowment, but this difference is less important than that which is caused by education or neglect. Whether for the purpose of facilitating mental processes, or of promoting practical efficiency in life's pursuits, a cultivated memory is much more valuable than a naturally strong one. We may be capable of amassing within our minds a vast amount of facts, or rules, or knowledge of any kind thrown together at random, without reaping any benefit, either in mental power or the

conduct of affairs; but when the memory has been so trained as to retain what is confided to it in classified order and make it available at every moment of need, its value cannot be overestimated.

Like all our other powers, the memory is strengthened and developed by exercise, and weakened by disuse. In whatever direction we make constant demands upon it, it responds obediently. The merchant finds no difficulty in remembering the prices and qualities of goods in his own line; the physician easily recalls the daily symptoms of his patient; the mechanic does not forget the functions of his various tools. The same conditions, daily repeated, will almost invariably bring up corresponding ideas, and in our regular employments we seldom have occasion to complain of a poor memory. This may afford a clue to the cultivation of this faculty in directions where it is now defective. If we would have it faithfully serve us, we must keep it in constant use. The same attention which we bestow on our daily business, and which enables us to recall its details with so much ease, will be equally effective if exercised in other matters. To strengthen the memory on any given point, the first requisite is to bring all our mental energy to bear upon it. We are charged with some message or commission, perhaps, which we promise in all good faith to convey or to execute; but not being in the line of our thoughts, it passes out of our minds and is unfulfilled. We commonly excuse ourselves for such dereliction, on the ground that we are unable, by any effort of the will, to command the power of memory. Yet had we, by a strong self-control, fixed our attention wholly upon the matter when presented to us, had we dismissed all wandering thoughts and concentrated our mental energies for the time upon that one thing, the impression would have been so strong that, in all probability, it would have been remembered and accomplished. This mental concentration is the first and most important means of improving the memory. It is largely within our own powers of will to enforce this, and he who is conscious of neglect in this respect cannot claim to be excused for forgetfulness.

Another valuable method of training the memory is through the laws of association. Our knowledge must be arranged and classified if we would recall it with facility. We must base rules upon principles, and effects upon causes, if we would imprint them firmly on our minds. That this is not done with sufficient thoroughness is the chief cause why so much of the knowledge which we acquire passes from us. The Emperor Napoleon, who was one of the most marked instances of a retentive mind, used to say of himself that his knowledge was all laid away in drawers, and that he had only to open the proper drawer and all that he had acquired on that subject was at once presented before him.

This is, as we have before hinted, one great need in our present systems of education. To take up a single study leisurely, presenting it to the student in all its relations, and leading him to trace its principles from their foundations up to their highest known results, is of far more real value, both as a mental discipline, and as a permanent acquisition of knowledge, than to skim over the surface of twenty branches, overloading the mind with isolated facts or rules, bearing no apparent connection with each other, and thus fixing no tenacious grasp upon the memory.

There is one great encouragement to the cultivation of the memory in the fact that the work will grow easier with every effort. If we patiently and steadily fix our attention on every subject we wish to recall, the power of concentration will become habitual. If we constantly arrange and classify our knowledge, it will grow more and more available.

Umbrellas, Past and Present.

Count d'Orsay, when reminded that, if he persisted in his extravagance, he would soon be unable to afford himself a carriage, replied that when he could not afford a carriage he would carry the best umbrella in London. The Count was true to his word, nor had he any reason to blush for the cheap and serviceable instrument. In the West it had been no doubt more used than honored; but looking to the East he found abundant sanction for his adoption of the unassuming umbrella. In bearing one he only followed in the steps of the kings and princes of Nineveh, Egypt, India, and China. From time immemorial, the contrivance for warding off the sun's rays and casting an artificial shade has been symbolical of the supreme human authority that can convert light to darkness, and in a trice drive ordinary mortals from the brightness of life to the gloom of death. No fitter emblem of his awful power could be imagined for the potentate who, by a word or a nod, could extinguish towards any of his creatures the sun of earthly happiness, and banish them suddenly to the abodes of gloom and despair, or could go yet further and by a glance put out the light of life. At every point of Oriental story one encounters the symbolical umbrella in literature and art. In the fifth incarnation of Vishnu, when the god goes down into hell, he bears in his hand a sun-shade. In like manner old bas-reliefs represent Dionysius bearing a parasol when he is descending to the infernal regions. To be a king in the East has from the remotest antiquity implied a right to bear an umbrella; and to be preceded by umbrellas has signified royal quality in the person following them. Indeed, the Eastern title with which we are more familiar than any other, signifies King of the Eternal Gingham. Satrap is a corrupt abbreviation of Ch'hatra-pati, i.e., Lord of the Umbrella, the title of the Mahratta Princes who reigned at Poonah and Sattara. The King of Ava's designation was "King of the White Elephant

and Lord of the Twenty-four Umbrellas." Writing to the Marquis of Dalhousie some two and twenty years since, the King of Burmah styled himself "His great, glorious, and most excellent Majesty, who reigns over the kingdoms of Phunaparanta, Tampadipa, and all the great umbrella-wearing chiefs of the Eastern countries." No English foxhunter would care to ride to the coverside at the tail of a company of walking or mounted umbrella bearers; but when the Emperor of China goes forth to hunt he is preceded by twenty-four umbrellas. Passing westward, the umbrella was adopted by the ancient Greeks and Romans, as a symbol of power, and a dainty article of feminine costume. The Greeks used it as a symbol in some of their sacred festivals, and put it in the hands of gentlewomen. Aristophanes and Pausanias both mention the lady's *skidion*. Bestowing it on their women kind of high degree, the Romans also elevated it in their halls of justice as a symbol of authority. A red umbrella was the symbolical canopy under which the Roman judge sat in the basilikon; and when the basilican law courts were devoted to religious uses and passed into the hands of Christian clergy, the new owners of the consecrated judgment halls were quick to see their advantage in assuming the emblematic umbrellas. Hence the red canopy became the distinctive ensign of the cardinal priest. In his church he officiated, at public gatherings outside his church he walked, beneath it. In course of time he dispensed with the real canopy and its bearers during public promenades, and substituted for it a small red canopy so made that he could bear it for himself on his own head. The cardinal's scarlet hat is but a modified and cleverly adapted umbrella. It is the direct outcome of the old symbolical sun-shades of the Oriental despots. That our English umbrella has the same magnificent descent is shown by its name, which signifies shade-maker. Lineal, though remote, offspring of the Biblical "shade defending from the sun," the modern umbrella was brought from Italy to England by Tom Coryat, who describes it in his "Crudities" (1611) as "something answerable to the form of a little canopy, and hooped in the inside with divers little wooden hoops that extend the umbrella in a pretty little compass," and he introduced it into England as a parasol. It was so natural for the ladies who used it against the sun to use it also against the rain, that one may presume the umbrella was at once employed in our humid climate as much for the one purpose as the other. So early as 1620, Drayton described it as a thing "to shield you in all sorts of weathers;" but the original and true purpose of the ancient invention was not lost sight of till long afterwards. In "Rule a Wife and have a Wife," Beaumont and Fletcher say:

"Now you have got a shadow, an umbrella,
To keep the scorching world's opinion
From your fair credit."

The closed sun-shade borne by the black page in the frontispiece to John Evelyn's "Kalendarium Hortense" (1664) is perhaps the earliest notice of the umbrella by pictorial art in this country. Between 1664 and 1710 umbrellas for protection against rain had become so common that, as we have seen, every tucked-up sempstress of Queen Anne's London had one. The umbrella which Under Sheriff Beardman permitted a footman to hold over Dr. Shebbeare's head in 1758, when that unfortunate gentleman of letters paid the penalty of his indiscretions by standing in the pillory, was doubtless an unusually strong contrivance, as it was used to ward off brickbats and rotten eggs, as well as to conceal the face of the culprit.

Though they did not invent the umbrella, the English have done much to develop and bring it to perfection. Between October, 1786, and July, 1871, no less than 292 improvements on the ordinary walking stick were patented in this country; and though some few of these patents refer to undraped batons, some 270 of them are for portable canopies. A considerable proportion of these open letters were granted for improvements in one or another of the subordinate parts of the sun-shade—such as ribs, stretchers, tips, handles, ferules, notches, springs; but the majority exhibit specifications that affect the general design or chief materials of the article. Indeed, an entire volume might be written about all the various projects for a perfect umbrella. The rhabdoskidophoros is an umbrella, with the drapery folded into a hollow stick, from which the canopy shoots forth and expands itself in a trice on the touch of a spring. The MacGregor umbrella may be used with equal effect against the rain or one's natural enemies, as it is fitted with a spear, and may be used as a bayonet. Just thirty years since an umbrella was invented for people with chilly hands, which had a curious little heating apparatus set in its handle. Draped canes have been fitted with sun dials, compasses, and watches. The lady's parasol riding whip is familiar to every one; but it is not every one who has seen a needle-gun cane, a fishing rod, and a pipe stalk fitted with a canopy for the protection of the sportsman or smoker. What would dear old Isaac Walton have thought of a fishing rod fitted with an umbrella? The special feature of another umbrella is a long falling curtain that, on the expansion of the *parapluie*, hangs from the tips of the ribs and the edge of the covering to the ground. When he is in motion, the bearer of this umbrella has the appearance of an unusually tall and animated pillar post; and in order that he may see his way, the falling curtain is provided with a little glass window, bow or otherwise, through which he can gaze on the astonished world. To another inventor we are indebted for an umbrella whose hollow staff is furnished with a pistol, some charges of ball and powder, a screw telescope, pen and ink, paper, pencil, and a small knife. In

the automaton umbrella the stretchers are put so high that the canopy can be brought down close over the bearer's head. The club umbrella, invented only a few years since, was peculiar in having a handle that could be unscrewed, so that on removing the handle and putting it into his pocket the owner might leave the canopy in the hall with an agreeable confidence that he would see it again on leaving his club, as no one would care to "borrow" a handleless umbrella. But this ingenious contrivance failed to find favor in Pall Mall, because it was felt to be an unclubbable act for a man to enter his club with an umbrella that implied a distrust of the honesty of the members of his joint-stock home. It is almost needless to say that the perfect umbrella of the future will combine all the features of all the previous umbrellas—that it will be a fishing rod, fowling piece, driving whip, sword stick, bayonet, tobacco pipe, writing desk, and pillar post tent, and have its handle fitted with a fireplace, a repeating watch, and a compass, and will weigh only eight ounces avoirdupois, the weight of the most delicately constructed Paris umbrella.—*Hatters' Gazette*.

Fishing Extraordinary.

There are extraordinary ways of fishing practised by people of uncivilized countries, which are not the result of ignorance, but of that ingenuity which is always rendered fruitful by dire necessity and the instincts of self-support.

A method employed by the Chinese is generally practised at night, and depends upon a peculiar power which a white screen, stretched under the water, seems to possess over the fishes, decoying them to it and making them leap. A man, sitting at the stern of a long narrow boat, steers her with a paddle to the middle of a river, and there stops. Along the right hand side of his boat a narrow sheet of white canvas is stretched; when he leans to that side it dips under the surface, and, if it be a moonlit night, gleams through the water. Along the other side of the boat a net is fastened so as to form a barrier two or three feet high. The boatman keeps perfectly still. If another boat passes by, he will not speak; he is only impatient at the slight breaking of the silence. While he keeps thus without a sound or stir, the fish, attracted by the white canvas, approach and leap, and would go over the narrow boat and be free in their native waters on the other side, but for the screen of netting, which stops them, and throws them down before the man's feet.

Every one must have heard of the fishing cormorant, which is actually trained in China to catch fish. A man takes out ten or twelve of these web-footed birds in a boat, and as soon as the boat stops, at his word they plunge into the water and begin at once searching for and diving after fish. They are most diligent workers, for, if one of them is seen swimming about idly, the Chinaman in the boat strikes the water near the bird with the end of a long bamboo; and, not touched, but recalled to a sense of duty, the cormorant at once turns to business again. As soon as a fish is caught, a word from the man brings the bird swimming towards him. He draws it into the boat, and it drops its prey from its bill. There is always a straw or string tied round the neck, to prevent the fish from being swallowed, and this string requires the nicest adjustment, lest it may choke the bird—a result which would certainly follow if it slipped lower down on the neck. The sagacity and workman-like method of the birds are shown when they get into difficulties. If the fish caught is too large for one beak to secure, another cormorant comes up to the struggle, and the two with united efforts bring their prize to the boat. On the rivers and canals near Ningpo, Shanghai, and Foo-chow-foo, the employment of these birds is by no means an uncommon sight; but they are never to be seen fishing in the summer months, their work being in the winter, beginning always about October and ending in May. The birds have of course to be subjected to a system of training, which is carried on in the cormorant breeding and fishing establishments, one of which is at a distance of thirty or forty miles from Shanghai.

A still more singular practice is to be found amongst the Chonos Indians, who train dogs to help them on their fishing expeditions in much the same way as the shepherd's dog helps the shepherd. The net is held by two men standing in the water, and the dogs, swimming out far and diving after the fish, drive them back towards it. They enjoy their work just as a good horse, though hard pressed, seems to enjoy the hunt; and every time they raise their heads from the water they tell their pleasure by clamorous barking. The Fuegians, one of the most miserable and degraded races on the earth, train their dogs in a similar manner to assist them in catching birds and sea otters. In times of famine, they kill the old women of their tribe rather than sacrifice their dogs, alleging, as Peschel says, that dogs catch otters, and women do not. They have a wonderful contrivance for killing the sharks which abound off their coasts. A log of wood, shaped so as to appear something like a canoe, is set afloat, with a rope and large noose hanging from one end of it. Before long a shark attacks the supposed canoe, swimming after it, and is caught in the noose, hanging from the stern. It closes on him so that he cannot extricate himself, and the weight of the log keeps him swimming slowly without being able to sink. Then the Fuegians in their canoes, generally steered by women, approach at their leisure and finish the shark with their spears.

All these contrivances of savage nations, or of the strangely civilized Chinese, are meant to kill or seize the fish by natural means. It is much nearer home that we have to look to find the element of superstition prevailing, and useless customs invested with the importance of charms. An in-

stance may be found in the case of the Sicilian fishermen, who, when in search of swordfish, chant a jargon of words the meaning of which even they themselves do not know. The song is supposed to be some old Greek verses, which, by time and use among those ignorant of their meaning, have become so altered as to be almost unrecognizable. The fishermen regard the medley as a sure means of attracting the swordfish, which they harpoon from the boat, when the charm, as they suppose, has brought them within reach.

Far away in northern regions there is a novel method of fishing under ice, which shows more ingenuity than the simple lowering and fastening of a net. A small square hole is cut in the ice, and in this is placed an upright stick, supported by a cross pin run through it and resting at each side on the ice; the end of the stick below this cross pin is short, and to it the line is fastened with the bait and hook attached, while at the top of the stick is a piece of colored rag. Now, though we have called the stick upright, it is meant to fall from that position and lie along the ice, until a fish seizing the bait pulls its lower end, when with a jerk it rises. This contrivance is called a tip-up, from the movement which is certain to follow the seizure of the bait. The fluttering of the colored rag, as the stick rises, tells of capture; and a great number of these self-acting fishers and indicators may be placed near together, each having its own hole in the ice; and each, by the fluttering rag, telling its own tale the moment a fish is caught.

The tip-up not only saves the fisher the trouble of holding his line in position and watching with particular care, but also makes the fish itself strike and announce that it is ready to be pulled out!

With bodies blackened by the sun to the color of the seaweed, the Japanese fishermen are incommoded by neither the rain nor the winds. Like the fishermen of all lands, their restless eyes were wandering from the sea to the heavens. With no guides but the stars by night and the blue edge of the land by day, there was need for keen eyesight and watchfulness. In all the Eastern seas there is no more adventurous race than these men.

We could see the floats of burnt wood which buoyed the ends of our fishermen's lines, and to the nearest of these we were sculled. A kind of wood light and buoyant, and with some resemblance to cork, is used for such floats. It grows in the forests thereabouts, and, after being shaped and charred to prevent decay, lasts, without further trouble, for a longer time than bladders or skins. With some impatience the black buoy and the line attached are brought on board. Like an inverted bell-shaped flower pot comes the first earthenware jar, hardly the size of a child's head, attached to the line. Mouth downward, the jar is pulled up from the bottom, and when all the water has been poured out, the fishermen give a look inside. No occupant being found, the jar is once more lowered into the sea by the attached string, which is overrun till the next jar is pulled up, brought on board, and similarly examined. When six or seven are examined, and no occupant is found in any of these, the fishermen show no impatience. But presently from a jar an octopus is jerked upon the floor of the boat, and with some satisfaction the Japanese watch its tentacles wriggle all about the planks and cling round their legs. Changing its hues, the disgusting cephalopod loses its redder blotches for paler patches, and eventually crawls into a darker corner to coil itself away. Pouring the water more carefully from the inverted pots, the fishermen secure a few more of these animals, which crawl and twine about with snakelike contortions. The long string of pots took time to overhaul, but the spoils were reckoned reward for the trouble. When the fishing was completed, and the black floats were again left to mark the spot, our boat was sculled somewhat further down the land.

We had then time to learn something more of this fishing for tako, as the octopus is named by the Japanese fishermen. Through our friends, we learn that the tako needs no bait to entice it to enter the earthen jars used by the fishermen to entrap it; but crawling about on the bottom, or shooting itself through the sea by the expulsion of water, it finds in the dark earthen jar "a comfortable house," and so occupies it until the fisherman finds it and captures it. The tako is largely eaten in Japan, where all the products of the sea are accounted equally wholesome with those of the land; and beneath an ugly skin the flesh of this speckled monster is thought very good, cooked in several ways, and eaten with or without soy or vinegar. Nevertheless, as if to vindicate the dread its constantly changing hues excite, the eating of the octopus is not unattended with danger. Through some poisonous taint, either occasionally or always present, but modified by the process of cooking, people sometimes die from eating this animal. And yet the knowledge of this interferes but to a trifling extent with the use of food having such a questionable reputation—indeed, at certain seasons, it is largely used by the Japanese, when the cuttle fish are far more plentiful and also more wholesome. Caught by trolling a small wooden fish barbed with hooks, they make good sport, chiefly to the older fishermen, who are not active enough to go off to sea.—*Chambers' Journal*.

DECISIONS OF THE COURTS.

Supreme Court of the United States.

CORSET PATENT.—MORITZ COHN, APPELLANT, VS. THE UNITED STATES CORSET COMPANY, JOHN H. LANE, AND WILLIAM LYALL. (Appeal from the Circuit Court of the United States for the Southern District of New York.—Decided October Term, 1876.)

A patent is invalid if the invention claimed is found to be patented, or described in a printed publication prior to the patentee's invention or discovery thereof; and it is enough if the thing patented is described, and not the steps necessarily antecedent to its production.

Thus, when the invention claimed is an article, it is not necessary, in order to render the patent void, that the prior publication should also contain a description of the process by which such article was made.

Unless the earlier printed and published description does exhibit the later patented invention in such a full and intelligible manner as to enable persons skilled in the art to which the invention is related to comprehend it without assistance from the patent, or to make it, or repeat the process claimed, it is insufficient to invalidate the patent.

Mr. Justice Strong delivered the opinion of the court.

A careful examination of the evidence in this case has convinced us that the invention claimed and patented to the plaintiff was anticipated and described in the English provisional specification of John Henry Johnson, left in the office of the Commissioner of Patents on the 25th of January, A.D. 1854. That specification was printed and published in England officially in 1854, and it is contained in volume second of a printed publication circulated in this country as early as the year 1856. It is, therefore, fatal to the validity of the plaintiff's patent, if, in fact, it does describe sufficiently the manufacture described and claimed in his specification. The plaintiff's application at the Patent Office was made on the 26th of January, 1859. In it he claimed to have invented "a new and useful improvement in corsets."

After reciting that previous to his invention it had been customary in the manufacture of corsets to weave the material with pocket-like openings or passages running from edge to edge, and adapted to receive the bones, which are inserted to stay the woven fabric, and which serve as braces to give shape to and support the figure of the wearer, but that it had been necessary, after the insertion of the bones into said pocket-like passages, to secure each one endwise by sewing, he proceeded to mention objections to that mode of making a corset. He specified two only. The first was that it involved much hand labor and consequent expense in sewing in the bones, or securing them endwise in the woven passages; and the second was that the arrangement or placement of the bones in the passages had to be determined by hand manipulation, and that it was therefore variable and irregular, such as frequently to give to the corset an undesirable shape or appearance near its upper edge. These objections he proposed to remove, and to produce a corset in which the location or position endwise of the bones shall be predetermined with the accuracy of the Jacquard, in the process of weaving the corset stuff or material, thereby effecting the saving of labor and expense in the manufacture. He therefore declared his invention to consist in having the pocket-like openings or passages into which the bones are put closed up near one end, and at that point at which it is designed to have the end of each bone located.

Amendments were then made until his present patent was at last granted, dated April 15, 1876. In the specification which accompanies it the patentee admits what he admitted at first, that prior to his invention it had been customary in the manufacture of corsets to weave the material with pocket-like openings or passages running through from edge to edge, and he makes the further admission that it had been customary to weave the material with such passages all stopped and finished off at uniform distances from the edge. He therefore disclaims "a woven corset with the pockets stopped and finished off at a uniform distance from the edges," and he disclaims also "a hand-made corset with pockets of varying lengths stitched on," and his claim is: "A corset having the pockets for the reception of the bones formed in the weaving, and varying in length relatively to each other as desired, substantially in the manner and for the purposes set forth."

NEW BOOKS AND PUBLICATIONS.

STRENGTH AND CALCULATIONS OF DIMENSIONS OF IRON AND STEEL CONSTRUCTIONS. Translated from the German of J. J. Weyrauch, Ph.D. New York city: D. Van Nostrand, 23 Murray and 27 Warren streets.

Another translation of this same work has already been briefly noticed in these columns; and we expressed the view that the contents of the volume were not in such practical form as would adapt it to the uses of the working engineer. The present translation seems to us much less open to that objection, and certainly it contains an immense amount of useful data, entirely outside the formulae, besides examples tending materially to elucidate the latter. The book is rendered much more practical; and its whole arrangement is, to our minds, better and well calculated to render its various topics more accessible to the student. As regards the intrinsic merits of Professor Weyrauch's work, and in our previous strictures on the other translation, we intended no disparaging reflection upon them; they are undoubtedly great, and the volume should be carefully studied by all engineers. It is based on a general view of the results obtained in the extended course of experiments made in Europe and in this country to determine the properties of iron and steel. As these trials have shown the somewhat startling fact that (to quote Professor Weyrauch) "the method hitherto employed in calculating the dimensions of iron and steel constructions have been entirely wrong," it is hardly necessary to point out the importance of any work which deduces a formula which gives all "the requisites for a simple and rational determination of dimensions."

VICK'S HORTICULTURAL PUBLICATIONS.—The enterprising Rochester seedsman, James Vick, has just issued his annual "Illustrated Catalogue" and "Guide Book," which are of interest to every farmer, in fact, to every class of persons living in the country. Mr. Vick's publications have always been signally well printed; but this year they seem to be more handsomely executed than heretofore. They contain useful information for vegetable growers, flower raisers, and amateur farmers. Coming first among the list before us, the largest, handsomest, and most expensively executed is the "Flower Vegetable and Garden," a book of 165 pages, full of engravings, some of which are full-page colored chromes of fruits and flowers. The next in importance is the "Illustrated Catalogue of Seeds and Bulbs," and then the "Floral Guide." These three distinct publications can be had of the publisher for 75 cents; and we know of no other way of obtaining so much practical knowledge and information for so small a sum as is afforded in these publications.

EVERY MAN HIS OWN LAWYER.—A new edition, revised and improved, of Wells' "Lawyer," comprising forms for drawing legal papers of all kinds and embracing a synopsis of the leading statutes existing in each State, has just been issued. The original edition of this work, and the several subsequent ones, have aggregated an enormous sale, and are to be found in a great many offices and households throughout the country. But the lapse of time has wrought such changes in the statutes of various States that the author has found it desirable to revise the whole book. The professional man, the farmer, the mechanic, the manufacturer—in fact, all classes of the community—will find the work useful for reference, and of great assistance in drawing deeds, making transfers of property, granting powers of attorney, or conferring licences, and a handy and reliable adviser, saving lawyers' fees to the possessor and teaching him his legal rights. The book is printed in both English and German. The price for English edition, by mail, is \$2.25; for the German edition, \$2.50. Sold by the author and publisher, J. G. Wells, No. 1 Great Jones street, New York city.

Recent American and Foreign Patents.

Notice to Patentees.

Inventors who are desirous of disposing of their patents would find it greatly to their advantage to have them illustrated in the SCIENTIFIC AMERICAN. We are prepared to get up first-class wood engravings of inventions of merit, and publish them in the SCIENTIFIC AMERICAN on very reasonable terms.

We shall be pleased to make estimates as to cost of engravings on receipt of photographs, sketches, or copies of patents. After publication, the cuts become the property of the person ordering them, and will be found of value for circulars and for publication in other papers.

NEW MISCELLANEOUS INVENTIONS.

IMPROVED LAST.

Charles E. Cree, Marlborough, Mass., assignor to himself and J. E. Curtis, of same place.—In this last the block is firmly held in place and prevented from slipping back while the shoe or boot is being lasted, so that the shoe or boot will have its full intended size. The block is wholly within the last, having no projecting part to come in contact with the upper while upon the last; and the last and block are kept together, except when being removed from the boot or shoe, so that the block cannot become lost, and no time will be wasted in looking for and sorting out the blocks of the lasts to be used.

IMPROVED WEIGHING SCALES.

Hosea Willard, Vergennes, Vt.—This invention is designed to improve the lever and beam scale for which letters patent have heretofore been granted to the same inventor under date of July 25, 1876, so that the construction of the same is simplified, and the gross or net weight taken in quick and perfect manner. This improved scale is used advantageously for weighing coal from boats, and other purposes, as the scale may be applied to the hoisting apparatus, and go with the bucket to the place of deposit, the indicator regulating the loading of the bucket, and determining thus the weight of a boat load with great facility, and without loss of time or labor.

IMPROVED BRIDLE ATTACHMENT.

Seton S. Cummings, Turner's Point, Tex., assignor to one third his right to Walker C. Stevenson, of same place.—This bridle is intended for training and taming horses; and it consists in the combination of brace and guide reins, neck and crupper straps, surcingle, and collar. A brace rein buckles into the bit rings, and runs through a ring attached to a strap that is secured to the neck strap, and thence it runs through a loop that is attached to the collar strap, and is finally secured to a ring that is attached to the surcingle by means of loops. The martingale is buckled into the bit rings, and passes through a loop in the front and lower part of the collar strap, and is fastened to the lower portion of the surcingle. All of the straps are duplicated, both sides being exactly alike; and they are provided with buckles or other convenient means for lengthening and shortening, to meet the requirements for horses of different sizes, and for the purpose of adjustment for different positions of the same animal.

IMPROVED CORSET.

Mrs. Maggie M. Harriman, Kansas City, Mo.—This improvement relates to the form and manner of cutting the first girdle, to the shape of the sides of the body or waist of the corset, and to the conjunction of short bones with a quilted portion on the back of the corset, whereby it is rendered more elastic, easy, and durable in wear, and adapted for use as a dress waist.

IMPROVED APPARATUS FOR PICKLING SHEET IRON.

John D. Grey, Baltimore, Md.—The ordinary or old process of removing the oxide from sheet iron is to lay the sheets in a tank containing dilute sulphuric acid. They are placed vertical, or nearly so, with their sides in contact. By this improved apparatus, the sheets are conveyed slowly through the tank, upon endless chains, thus saving much labor in handling, lessening the time required for pickling, and enabling the acid to act upon the sheets more uniformly.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED SAW-FILING MACHINE.

Samuel V. Pattillo, Greenville, Ala., assignor to himself and Frank J. Kohn, of same place.—This is an improved filing machine by which the gin saws may be quickly, uniformly, and effectively sharpened. The machine is operated by adjusting, first, the file vertically to one saw after the other by means of the center screw post and hand wheel, and filing the teeth of each saw at one side. The saw cylinder is next taken out of the centers and reversed, and the machine adjusted for left hand filing when the same operation of sharpening the teeth of each saw is performed as before, and thus a rapidly working and very effective filing machine for gin saws is obtained that accomplishes the work in better, speedier, and more uniform manner than by hand.

IMPROVED DYNAMO-ELECTRIC MACHINE.

Dieudonné F. J. Loutin, Paris, France.—This invention consists, first, in combining a magneto-electric machine, in which the induced magnets are stationary and the inducing magnets movable, with a dynamo-electric device for producing currents invariable in direction, for the purpose of exciting the aforesaid magneto-electric machine; and, secondly, in increasing the length of cores of the stationary inducing electro-magnets of the device employed for producing currents invariable in direction, so as to permit one or more wires to be placed thereon, from which alternate currents in opposite directions may be taken, by which arrangement currents invariable in direction are obtained from the induced magnets of the wheel, and also alternate currents in opposite directions from the additional coils upon the lengthened inducing magnets, without the use of collectors or commutators.

IMPROVED WRENCH.

James Shepard, Angola, Ind.—This wrench is easily and quickly operated, as the turning of the handle moves both jaws, the same admitting to be opened wider, to be applicable to larger burs, while the length and leverage is increased jointly therewith. It has a handle with exterior and interior screw threads, that move jointly the jaws having intermeshing threads, the outer jaw being guided in an oblong recess of the inner jaw.

IMPROVED WINDMILL.

William T. Burrows, Nashua, Iowa.—The shaft of this wind wheel is so pivoted to the head of the tail vane that, in turning out of the wind under the influence of great force, the wheel will swing up an incline, whereby its own tendency to swing back down the incline is the means of keeping the wheel in the wind; and, in combination with a wheel in this arrangement, it is proposed to arrange a vertical vane behind the wheel on a pivoted bar, and connected to the vibrating wheel frame, to pull the wheel up the incline, in order that it will swing out of the wind more easily, and the lever of this vane will be weighted to regulate its action, to accommodate the wheel in so swinging out of the wind.

IMPROVED ORE FEEDER FOR QUARTZ MILLS.

George A. Church, Nevada City, Cal., assignor to himself and Edward L. Montgomery, of same place.—This is an improved device for feeding ore to the mortars in quartz mills, so constructed as to feed the ore to the mortar only as it is wanted, which will feed dry and wet ore with equal facility, which will not allow soft running stuff to run through and fill the mortar, and which will not impair the effect of the blow of the stamp by which it is operated.

IMPROVED RELIEF AND SAFETY STOP VALVE.

Charles P. Wiggins, St. Louis, Mo.—The object of this invention is to prevent accidents from carelessly closing the feed pipe while the pump is in motion, and it is so constructed as to always leave an open discharge. It consists in a relief or safety stop valve, formed of the shell provided with an inlet, two outlets, and two valve seats, and the double valve, so arranged that it can close only one outlet at a time, to adapt it to be interposed between the boiler and the check valve of the pump discharge pipe.

IMPROVED HOISTING MACHINE.

Daniel H. Merritt, Marquette, Mich.—This is an improved hoisting machine of considerable power, operated by a friction gearing at varying motion, and capable of being stopped at any moment, to support the load to be hoisted, by a superior brake arrangement; and it consists of a hoisting drum which is operated with friction wheels, and whose shaft is adjusted in parallel manner by eccentric sleeves with slotted arms, connecting rods, and a worm and toothed segment gear. The brake is applied by a similar gear to the other end of the drum, capable of adjustment to wear, being taken off by a brake shoe and supporting arm at the lower end.

IMPROVED CAR COUPLING.

Benning Howell, West Sparta, N. Y.—This invention is an improvement in the class of car couplings which are automatic in their operation. The improvement relates particularly to a device which acts as a trigger to support the coupling pin in position to engage the link when it enters the drawhead, and also serves to hold the link horizontal, or at any required angle in a vertical or horizontal plane, so that it will enter the drawhead of another car; also to a pawl lever whose function is to operate the coupling pin of the drawhead and to lock or hold the same in position when it has engaged the link.

IMPROVED TREADLE.

William B. Floyd, Kansas City, Mo.—This invention relates to an improvement in that class of sewing machines and other treadles that are worked by the alternating raising and lowering of the feet and legs in place of the forward or backward motion of the feet, so as to remove all strain from the ankles, and give the operator more power with less exertion than with the common treadle. It consists of two treadles, that are arranged in adjustable manner on the laterally swinging treadle bar, that turns by its crosspiece in suitable bearings. The treadles are pivoted longitudinally and laterally, to adapt themselves to the position of the feet. The compound pivots of the treadles renders the motion of the same natural and easy, so as not to fatigue the worker as much as where the feet and ankles alone do the work. The feet do not change their relative positions to the legs by the adjustment of the treadles to their position, so that there is no strain upon the ankle joints, but only upon the knee and thigh joints, which can perform more labor with greater ease, on account of their greater strength.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED AUTOMATIC WAGON BRAKE.

Charles T. Warren, Atlanta, Ga.—This improved brake for vehicles is so constructed that it will be applied to the wheels by the operation of holding back, and at the same time will allow the vehicle to be backed without its being thrown into action. The construction is simple and ingenious, rendering the device excellently adapted to its purpose.

IMPROVED DUMPING WAGON.

Robert A. Reed, Hoboken, N. J.—This is an improved device for attachment to trucks, cars, wagons, carts, and other vehicles, to enable their loads to be readily dumped. By the construction, by turning the shaft in one direction the forward end of the body or box will be raised to dump the load; and by turning it in the other direction, the body or box will be drawn back into a horizontal position.

IMPROVED MITERING MACHINE.

Josiah H. Mosher and John Pennington, Pewamo, Mich.—This improved mitring machine is for use in the manufacture of picture frames, moulded frames, and for the cutting and putting together of frames on any desired angle and length. It consists of a basepiece with graduated guide rails, carrying sliding frame supports with adjustable saw guides secured thereto. The mouldings are first cut at the required miter, and then brought to a perfect joint by running the saw through the joint of the mouldings while they are firmly clamped together. They are then fastened by glue and nails, and thereby two corners of the frame connected in an easy, quick, and effective manner. The mitring and jointing of frames and mouldings is thus accomplished by a simple, accurate, and readily operated device.

IMPROVED SINK.

Benjamin Wallace, New York city.—This is an improvement on the sinks used in kitchens, tenement houses, etc., by which the rotting of the surrounding woodwork by the running or splashing over of the water is prevented, a more effective and readily changed strainer is obtained, and a tight joint between sink spout and conducting pipe, to avoid leakage, is formed. It consists of a sink with side and back guards extended above the horizontal flanges or seats.

IMPROVED CAR SCREEN.

William De Courcy May, Baltimore, Md.—This screen is shaped and folds like a lady's fan. It is attached to the side wall of the car, and may be extended and held open in a vertical plane, at right angles to said wall to prevent air currents from the open windows striking directly upon the passengers occupying the contiguous seats. The fan may be locked, by a catch, in the open or closed position, and constitutes a desirable as well as ornamental appendage of the car.

IMPROVED THILL COUPLING.

Benjamin P. Morrison, Abingdon, Va.—This thill coupling retains the shafts in strong and safe manner on the axle without a detachable bolt, avoids rattling, and allows the ready taking off and replacing of the shafts or poles when the vehicle is placed in the carriage house. It consists of a hook-shaped shaft head, that is locked to a cross bolt, with central flat eccentric part swinging in the ears of the axle clip and entering the recess of its shaft head. The hook-shaped end of the shaft head is first introduced into the ears of the clip while the front end of shaft is resting on the ground, and the flange of cross bolt hanging down. The shaft is then raised as nearly as possible to the perpendicular, so that the shaft head may pass down between ears far enough for the flange of bolt to be swung into the opening or recess in shaft head. The shaft is then lifted in upward direction until the bottom or rear part of recess is brought in contact with flange of bolt, when the shaft may be swung down to the ground. A thin strip of leather is interposed between the flange of bolt and shaft head to form a tight fitting of the parts, and prevent rattling. The shaft cannot become detached when in use, has no nuts to work off or bolts to be taken off in attaching and detaching, and forms a simple and effective device for quickly taking off and applying the shafts or poles.

IMPROVED COMBINED FREIGHT AND STOCK CAR.

Jones R. Matland, Hot Springs, Ark.—This consists of a freight car, with jointly-sliding upper and lower sections, that either close or open the upper and lower openings of the car. The upper sections are guided by friction rollers on strips, and are moved in division casings with inclined bottom rails, having suitable openings for the shedding of the entering rain. When stock is transported, the sections are thrown open and locked by spring bolts. When freight is to be shipped, the sections are closed in similar manner, providing thus a stock or freight car, as required by the service of the road.

IMPROVED CENTER-DRAFT SIDE THILL.

Conrad H. Matthiessen, Odell, Ill.—The object of this invention is to construct wagons provided with side thills in such a way that there may be no side draft; and it consists in the combination of a lever, wire rope, keeper, pulley, wire rope or rod, and spring, with a side thill, whiffletree, and running gear of a wagon. The effect of the arrangement is to take the draft from the rear axle, the pole being merely used for holdback and steering purposes. The vehicle is thus made to run more steady, with better guidance, and less side draft.

NEW AGRICULTURAL INVENTIONS.

IMPROVED CORN PLANTER.

George Tatlock and Stanford Newby, New Philadelphia, Ind.—This is an improved machine for planting corn, which opens a furrow to receive the seed, drops the seed at regular distances apart, and covers it, and is so constructed that the planting device can be detached and the rest of the machine used as a plow or cultivator, by detaching the side bars, the wheel the dropping cylinder, and the hopper, and bolting the forward ends of the handles to the plow beam. The seed is received from a dropping cylinder and conducted to the ground by a spout, which passes down through holes in the beam and standard.

IMPROVED ANIMAL POKE.

Benjamin D. Watson, Durant, Miss., assignor to himself and James C. Watson, of same place.—The object of this invention is to provide a yoke that shall prevent animals from jumping over or destroying fences. A saddle is conceived to fit the under side of the body of the horse, and secured in place by a strap that passes over the horse's back. A mortise is made in the saddle to receive an arm which is provided with a slot. A pin passes through the saddle and through the slot. The arm is provided with a point and a perforated spring, the latter acting as a guard for the said point. Another arm is joined to the arm already mentioned, and is capable of being raised into a horizontal position, but is prevented from rising further by the shoulders of the joint. The former arm is placed between the front

legs of the horse, and the latter is connected with a headstall by a strap. When the horse attempts to jump, the raising of the head or striking the second arm into the fence or other object presses the point through the aperture of the spring into the chest of the horse.

IMPROVED SEED PLANTER.

Harvey J. Robinson, Carpinteria, Cal.—This is an improved machine for planting potatoes, corn, and other seeds, so constructed as to plant the seed so deep as to be beneath the dry soil so that it may have sufficient moisture to make it grow, which will prevent the moist and dry soil from becoming mixed, and which will cut off any weeds that may be growing upon the land being or to be planted.

IMPROVED HORSE HAY FORK.

Peter Grant, Clinton, Ontario, assignor to himself and John B. Grant, Brussels, Canada.—This fork is to be used for loading and unloading hay and other similar substances by means of horse power. It consists of a central tubular line and lateral lines. A tubular plunger fits into the central line, and is provided at its upper end with an eye or hook, and is plugged at its lower end, and provided with ears, between which bars are pivoted. A spring is clamped to the line by a band and screw, and is provided with a catch pin, which passes through a disengaging lever and side of the central line into a hole in the plunger. The lever rests under the spring, and is held in place by the catch pin. The free end of this lever is bent upward, and provided with a small pulley. A key passes through a mortise in the central line and through a slot in the plunger, for limiting the motion of the said plunger. The end of the key is bent over the front of the central line, and is formed into an eye for attaching the disengaging cord which runs over the pulley.

IMPROVED PLOW.

John Preston, Millford, Ky.—This plow is intended to be used for laying off or marking land, and for making hills for tobacco, cabbages, and other kinds of plants to be transplanted, for covering corn, and as a shovel plow. It consists in the combination of a curved beam, provided with a plow plate and a rigid perforated bar, a slotted beam, a standard, provided with the square plow and the roller, and handles. In using the plow for preparing the ground for transplanting plants, the shovel plow opens a furrow, along which the square plow follows, pushing the loose soil before it. At the point where each plant is to be set out the plow handles are raised, which causes the square plow to leave and pass over the soil collected before it. As the square plow is again dropped to the ground, the roller presses upon the little heap of soil left by the square plow and flattens and smooths it, ready to receive the plants. For covering seed, the beam is detached, the square plow is drawn along the furrow, and is raised by the handles at each hill. To adjust the machine for use as a shovel plow, the beam and the square plow are detached, and the shovel plow plate is attached to the standard.

IMPROVED CLEARING ATTACHMENT FOR PLOWS.

Jonathan F. Dock, Elkhart, Ind.—This invention consists of a frame bolted to the plow beam, and carrying a serrated roller, that revolves on a vertical axis above the upper edge of the plowshare, and a jointed hook, that projects diagonally from the said frame, for drawing stubble, weeds, etc., into the furrow as it is turned. The frame is secured to the plow beam by a bolt that passes through a slotted arm projecting from the frame. The advancing end of the lower portion of the frame is pointed, so that it may readily pass through stubble and weeds. The roller is grooved spirally in opposite directions, forming diamond-shaped projections, which engage with the surface of the earth as it is turned up by the plowshare, and insure its rotation. This roller assists in turning the furrow, and also rolls the weeds under. The hook is drawn along upon the surface of the ground, and draws in the stubble and weeds as the furrow is turned. The spring permits it to follow the inequalities of the ground.

IMPROVED SCYTHE SNATH FASTENING.

Miles Smith, Springfield, Vt.—This invention is an improvement upon the patent granted the same inventor January 16, 1877, for a similar invention, in which the tang or toe of the scythe blade was contained in a socket plate arranged to swing so as to give the desired adjustment to the scythe blade, and which socket plate was held to its adjustment by a screw bolt. The object of the present improvement is to provide means for more rigidly holding the socket plate and the scythe blade in their corresponding adjustments, to which end it consists in roughening the under surface of the free end of the socket plate, and combining it with a plate upon the snath having a corresponding roughened upper surface, which plate operates both as a bearing for the clamping bolt and a clutch plate for the swinging socket to hold the latter in rigid position when the clamping bolt is screwed up.

IMPROVED COTTON PICKER.

Orren R. Smith, Raleigh, N. C.—The chief feature of this invention consists of two or more series of pickers formed of flexible spines or toothed rods depending vertically from pivoted bars arranged horizontally, but vibrating in vertical planes, successively. The said pickers strip the cotton from the bolls and by their inter-action carry it up and deliver it to a carrier, by which it is conveyed to a receptacle in rear of the pickers.

IMPROVED DITCHING MACHINE.

Silvanus P. Evans, Ash Ridge, O.—This invention consists in providing a ditching machine with an apparatus whereby the shoe which bears the coulter may be quickly and readily lowered or raised, as it is desired, to cut the ditch or trench deeper or shallower. It also consists in extending up from the coulter an inclined plane or mouldboard, the upper edge of which projects over a trough or gutter bearing an endless band moved by side chains and end rollers, so that the slice of earth cut by the coulter and side knives of the machine may be broken up in its fall from said mouldboard and more easily delivered to the chute at the rear of the machine.

NEW TEXTILE INVENTION.

IMPROVED LOOM SHUTTLE.

Ezra W. Marble, Wilkesonville, Mass.—This improved shuttle is so constructed that the cop may be placed upon the spindle without having its interior snarled, as is the case when the ordinary spindle is used, thus avoiding the great waste of cotton from the snarling. The spindle is held in place by a lever that supports the heel of spindle with an oval end, while it is itself supported at the other end by a spiral spring. The oval end of lever is designed to help in closing up the spindle when raised at the point out of the shuttle box to receive the cop. The socket for the end of spindle is made to fit a round hole with a side groove at the bottom, to accommodate each of its ears. It is inserted within the shuttle by placing the ears lengthwise of the slot that is intended to receive the spindle, and, after being pressed down to bottom of hole, turned around to let the ears into the side groove.

NEW HOUSEHOLD INVENTIONS.

IMPROVED FOLDING CHAIR.

Ernest Smith, London, England.—This folding chair may be easily folded and unfolded, may be adjusted into various positions for use, may be compactly folded for storage or transportation, and forms an easy and comfortable resting place however it may be adjusted. The invention consists in pins, hooks, holes, and pins for connecting the rear legs with the forward legs of the chair frame, and in the chair frame formed of the front legs, the rear legs, the seat bars, and the jointed arms, and their rounds or cross bars, constructed and combined with each other.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion. If the Notice exceeds four lines, One Dollar and a Half per line will be charged.

Patent of Churn for sale. Also wanted a partner to patent it in foreign countries. Address G. W. Knapp, Arbuckle, Mason Co., W. Va.

Improved Put Friction Twisting Engines of any power and style. J. S. Mundy, Newark, N. J.

Will give \$300 for Steam Launch. Whitfield, Bay St. Louis, Miss.

Diamond Saws. J. Dickinson, 64 Nassau St., N. Y.

Improved Spoke and Hub Machinery manufactured by Colborne Bros., Menasha, Wis.

A new deposit of Plumbago or Graphite, said to be the finest in this country, is now being worked at Uehland, Chester County, Penn.; both granular and flake are worked to perfection. The Eagle Plumbago Co., at Uehland, Chester County, will give all information on application.

Book Binders' Case Binding Machine. Send for illustrated circular. Frank Thomas & Co., Cincinnati, Ohio.

Help for the weak, nervous, and debilitated. Chronic and painful diseases cured without medicine. Pulvermacher's Electric Belts are the desideratum. Book, with full particulars, mailed free. Address Pulvermacher Galvanic Co., 222 Vine St., Cincinnati, Ohio.

For Sale.—6 ft. Planer, \$275; 33' Lathe, \$300; 16' Lathe, \$175; 23' Lathe, \$250; at Shearman's, 132 N. 3d St., Philadelphia, Pa.

Silver Solder and small Tubing. John Holland, Cincinnati, Manufacturer of Gold Pens and Pencil Cases.

Steam Yachts for sale, new, 14 feet long, 4 feet beam, 1/2 h. p., \$250; 18 feet long, 4 1/2 feet beam, 1 h. p., \$350; 21 feet long, 5 1/2 feet beam, 2 h. p., \$425. Shipping weights 450, 800, and 1,200 lbs. Will carry comfortably 4, 8, and 12 persons. Send for particulars. S. C. Forsyth & Co., Manchester, N. H.

For sale cheap—Two valuable Patents (Household Articles). Address J. A. Worley, Cleveland, O.

Amateur Photographic Apparatus, Chemicals, etc. Outfits, \$5 to \$25. Sackmann & Co., manufs., 278 Pearl St., N. Y.

Persons wishing to have any new article invented, address John Meyer, 717 Craig St., Covington, Ky., inventor of over 500 inventions of all kinds. Permutation and Time Locks a specialty.

Patent Right for sale, either by State rights or the whole of the U. S. and Canada; new invention; a Saw Mill Dog. For further particulars, apply to Alfred McPham, Fayette, Fulton Co., Ohio.

Parties having Room and Power, favorable located, and would like to assist in establishing a profitable Manufacturing business in the Hardware line, are requested to address for particulars, P. O. Box 451, Athol, Mass.

How to make Violins. Write to J. Ranger, Syracuse, N. Y.

Platform Clothes Wringer, Centennial Prize Medal Awarded for being "perfectly self-regulating, and well fitted for the purpose intended." License to manufacture granted. J. K. Dugdale, Richmond, Ind.

Glass Cylinders Tempered in Oil. T. Degnan, 129 Milk St., Boston, Mass.

600 New and Second-hand Portable and Stationary Engines and Boilers, Saw Mills, Wood Working Machines, Grist Mills, Lathes, Planers, Machine Tools, Yachts and Yacht Engines, Water Wheels, Steam Pumps, etc., etc., fully described in our No. 11 list, with prices annexed. Send stamp for copy, stating fully just what is wanted. Forsyth & Co., Machine dealers, Manchester, N. H.

Gas lighting by Electricity, applied to public and private buildings. For the best system, address A. L. Bogart, 702 Broadway, N. Y.

Power & Foot Presses, Ferracute Co., Bridgeton, N. J. Superior Lace Leather, all sizes, cheap. Hooks and Couplings for flat and round Belts. Send for catalogue. C. W. Army, 148 North 3d St., Philadelphia, Pa.

For Best Presses, Dies, and Fruit Can Tools, Bliss & Williams, cor. of Plymouth and Jay Sts., Brooklyn, N. Y.

Lead Pipe, Sheet Lead, Bar Lead, and Gas Pipe. Send for prices. Bailey, Farrell & Co., Pittsburgh, Pa.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing metals. E. Lyon & Co., 470 Grand St., N. Y.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 39 Park Row, N. Y.

Steel Castings from one lb. to five thousand lbs. Invaluable for strength and durability. Circulars free. Pittsburgh Steel Casting Co., Pittsburgh, Pa.

For Solid Wrought Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

Shingle Heading, and Stave Machine. See advertisement of Trevor & Co., Lockport, N. Y.

Hand Fire Engines, Lift and Force Pumps for fire and all other purposes. Address Rumsey & Co., Seneca Falls, N. Y., U. S. A.

The Zero Refrigerator was awarded a grand Centennial medal. Send for book. Lesley, 226 W. 2nd St., N. Y. Etterich's Screw Cutting Machine is great in demand. Circulars free. Etterich & Co., 63 Chatham St., N. Y.

Patent Scroll and Band Saws. Best and cheapest in use. Cordesman, Egan & Co., Cincinnati, O.

Best Glass Oilers. Cody & Rathven, Cincinnati, O.

Notes & Queries

J. S. will find directions for making lard oil on p. 283, vol. 30.—H. C. W. should read our articles on the management of boilers on p. 263, vol. 36. As to testing boilers, see p. 246, vol. 34.—W. E. can plate brass, etc., with nickel by the process described on p. 235, vol. 33.—O. E. will find directions for making oil of peppermint on p. 219, vol. 31.—E. O. T. will find an excellent recipe for cement for mending roofs on p. 187, vol. 35.—J. H. will find a recipe for tough glue on p. 43, vol. 32.—D. A. G. will find directions for making impression paper on p. 278, vol. 38.—T. S. L. can remove paint spots

from glass by following the directions on p. 235, vol. 36.—J. T. S. will find a description of the Gatling gun on p. 143, vol. 26.—A. C. will find a description of an hydraulic press on p. 315, vol. 35.—A. H. D. will find a description of the nitrate of silver process of making mirrors on p. 267, vol. 31.—D. S. M. will find directions for kalsomining on p. 351, vol. 34.—P. A. N. does not send sufficient data.—R. F. I. will find directions for building an ice house on p. 251, vol. 31.—E. B., C. P. Q., J. W. B. N. C., G. P., R. K. B., J. F. P., W. H., J. P., and others, who ask us to recommend books on industrial and scientific subjects, should address the booksellers who advertise in our columns, all of whom are trustworthy firms, for catalogues.

(1) O. C. K., of Leipsic, Germany, says: To make lead pipes nearly harmless, as regards the poisonous properties of the lead salts soluble in water, fill the pipes for a short time with dilute sulphuric acid ($80\text{H}_2\text{SO}_4 + 10$ or $20\text{H}_2\text{O}$). The pipes will become covered with a thin coating of sulphate of lead (80PbSO_4), which is far more insoluble in water than the oxyhydrate of lead (PbOH_2) generally formed.

(2) A. G. says: I have a rough chamois skin leather bag, into which, by some mistake or other, there came some English vermilion, dry. How could I clean it out? A. Vermilion is a compound of mercury with sulphur, and there is no solvent for it that would not damage the materials of the bag. Remove as much of it as you can with a stiff brush, and then cause an energetic stream of water to impinge upon the discolored surface, so as to mechanically carry off the particles of the pigment.

(3) G. B. S. asks: 1. Will tin (old cans, etc.), copperplated, do for the coppers in a gravity battery? A. Yes. 2. Will salt (sodium chloride) do for the saline substance? A. Better use sulphate of zinc. 3. Will common plate (window) glass do for the plate in an electric machine? A. Yes, but it is not the very best.

(4) W. M. M. says: I have a magic lantern, and want to know what kind of oil gives the best light for it. A. Kerosene gives as good a light as any, and better than most others.

(5) C. M. asks: What can be applied as a depilatory on horses, destroying the pigmentary granules yet not destroying the life of the hair? The object in view is to brand colored horses with a white brand. A. This is not practicable. The color of the hair above the cuticle may be bleached by the application of chlorine water or nitro-muriatic acid (*aqua regia*). It is not probable, however, that the action of these will be rapid enough for your purpose.

(6) C. E. H. says: Four years ago I had in a mill an upright shaft of eight inches diameter which, with attached gearing, weighed several thousand pounds. The toe on which it turned commenced cutting badly. It was impossible to remove the toe. Washers of steel raised the shaft too high out of the step, wore out rapidly, and did not work thoroughly well. I went to a number of machine shops for advice. One told me to grind it out with emery; another said my only course was to take down the shaft and send it by rail to the shop, and none could give me any speedy and economical cure for the trouble. At length I met the right man, who told me to raise the shaft and put under the toe (in the step) an old-fashioned large-sized copper cent. This I did, and the heating and cutting ceased at once, and the difficulty was permanently overcome. Since then I have put small cents in the steps of millstone spindles and always with good effect. The grooves filled up with the copper, and the toe looked as though it were copperplated and burnished. I even got to introducing a small copper cent under each new spindle, and think that so doing prevented cutting.

(7) A. J. F. asks: How can I set the lenses of an eyepiece to a telescope? It is composed of two plano-convex lenses. A. The Huyghenian eye lens is one third the focus of the field lens, and is placed its own focal length with the focus of the latter.

(8) A. L. S. says: I learn from tables on the heat of water with steam, that 60 lbs. pressure equals 292.6°F . Is this the degree of heat under any and all circumstances? A. This is for fresh water. The temperature changes, if the water contains impurities.

(9) G. W. K. says: I have tan vats which have not been used for some time. I keep them full of water to preserve them. How shall I keep mosquitoes from breeding in them? A. Cover them tightly.

(10) E. C. H. says: I wish to fill up a low place in a lot with a mixture of sand and gravel. How much will it settle after leveling it off 1 foot deep with no packing? Surface of plot is a rich loam, subsoil a clay bottom. A. From $1/4$ to $1/2$.

What is the thinnest circular saw I can use 10 inches in diameter for sawing 2 inch white oak, saw running on 700 revolutions per minute with 2 horse power? A. One of No. 10 gauge, or about $1/16$ of an inch thick.

(11) I. says: Nearly all lugs or supports riveted to steam boilers have three on each side, one of them in the middle of the boiler; so, if either end of the support settles, the whole weight of the boiler of water is hung by the middle. This is all wrong. There should be either two or four supports on each side of the boiler, the longest space between the two inside ones. Is not this so? A. Yes. We could not tell you why the former course is pursued, except that common sense is scarce.

Why is it that persons at this period of mechanical science place tightening pulleys on the lead line or pulling side of a belt? A. We do not know, but we are glad to call attention to these points again, as we have frequently done before.

(12) G. H. A. says: I sometimes preserve eggs in lime water, and they keep well, but look lumpy after taking out of the solution, notwithstanding that I let the lime settle in the water till it looks clear, and dip it out, leaving the lime behind. Is there anything that I can put in to remove what little lime stays in the water? A. We think filtering will answer the purpose. Place a piece of filtering paper in a funnel, and pour in the liquid.

(13) C. S. O. asks: 1. Has the compound engine any advantage or economy other than shortness

of stroke over a single cylinder sufficiently long to secure an equal amount of expansion? A. It is claimed that the machinery can be made lighter, with the compound engine, for high grades of expansion. 2. Will highly volatile liquids give more power than water in an engine, from the same fuel? A. Not necessarily.

(14) G. S. C. asks: Could not hot air balloons be used for aerial navigation, if a light furnace were constructed which would constantly run a hot current into the balloon? A. It would be difficult to carry enough fuel for an extended voyage. Fire balloons have been used successfully for short trips.

(15) A. S. E. says: The centrifugal force on the sea board and that on the top of the highest mountain is considerable. The specific gravity is the same. Let a globe be turned rapidly, and water put on; it climbs to its greatest diameter, and flies off. Two canals are cut at the same declivity, one north and the other south; the velocity is the same in both. Neither does this influence affect the wind. Please explain the law that counteracts this influence and produces the equilibrium? A. There is a slight difference in the effect of gravity at the different levels.

(16) C. G. V. P. says: Is it practicable to heat the passenger cars with the steam from the locomotive? If so, in what manner is the steam conducted from the boiler? It seems to be a failure in Europe, and some of my European friends ask me what the SCIENTIFIC AMERICAN thinks about it. A. It might be possible, but it would be necessary to increase the size and weight of locomotives. Steam pipes could be arranged in a similar manner to the air pipes used with continuous brakes.

(17) M. W. H. says: How many lbs. pressure can an ordinary horse exert, when doing its best? A. Between 300 and 400.

1. What is a high pressure engine and boiler? Is it not one that condenses its steam, and uses the water over again? A. In the common acceptance of the term, a high pressure engine is non-condensing. 2. What steam pressure will a vat sustain, if made of 2 inch plank of oak, matched, and covered with heavy sheet iron, both out and inside? It is 3 feet in diameter and 10 feet high? A. Your data are insufficient.

1. How can phosphorus be made into solution for using on gun sights after night and other similar purposes? I dissolved some in hot olive oil, also in turpentine, but it settled and formed a hard body as soon as cooled, in both. What is the trouble? A. Probably the ingredients were not pure. 2. What is the coldest temperature in which phosphorus will glow or show light? A. About 32°F .

(18) F. R. H. says: I have an iron tank 4 feet in diameter by 12 feet long, in which I put dead stock to be steamed out. This tank is supplied with steam from a portable boiler and engine. The steam dome is 1 foot high, and the pipe rises from the dome $1 1/4$ feet in three turns, and goes 6 feet down into the tank in the bottom. When I turn on the steam to the tank the water blows from the boiler faster than I can pump it into the boiler, at the same time running the steam down. It has only begun acting so lately. Can you tell me how I can overcome this difficulty? A. It is not unlikely that your pump is out of order. You can regulate the amount of steam let into the tank, so that the pump will supply what is taken away.

(19) W. F. A. says: I have tried to bend basswood, but have failed. I gave it a long steaming, and it would break off short. Then I tried a short steaming, but it worked in the same way. Can you give me some information? A. It is very possible that the specimens you tried were not suitable. It may be that any kind of wood can be bent at pleasure, by a proper treatment, but the methods are not generally known. There is now for sale in this country bent-wood furniture, which is, we believe, manufactured abroad by a secret process.

(20) A. B. says: I saw in the SCIENTIFIC AMERICAN, of January 30, an engraving of a new water velocipede. Please tell me if the two floats would be better if they were of the shape of a triangle, and what should be the distance between the floats? How long, from end to end, and of what size should the paddle wheel be? What should be the thickness of the floats, and what would be the best material to make them, in case of stones or rocks in the river? A. We think the cigar shape is best for the floats. Their size depends on the load to be carried, and must be calculated for any particular case. Distance apart, 2 to 4 feet, according to capacity, will do. They could be made of light iron, for clear water, and of wood for rocky places.

(21) F. W. B. asks: What power can I use to run a dental engine and a small polishing lathe head? I have tried water motors, but they fail. A. We think there are water motors in the market that will answer. There are also small steam and electric engines suitable for the purpose.

(22) S. N. M. says: 1. I read that the earth's rotation is retarded 22 seconds a century = 0.22 seconds a year. Also that two thousand million years ago, the earth was rotating twice as fast as now. I figure thus: Earth now rotates in 86164.09 seconds, and $2 \times 0.22 = 195,387$ years ago earth rotated twice as fast as now. Am I wrong? I also find the following: "It therefore follows that she was rotating at about the same rapidity as now, when she became solid; and as the rate of rotation is certainly diminishing, the epoch of solidification cannot be more than ten or twelve millions of years ago." How can this be? A. Your calculation does not seem to be correct. The assumption is for 0.22 seconds a year at present. We presume the article gives reasons for the second statement, which is not very alarming to the present generation, even if true.

(23) W. C. W. asks: How will a cast iron vertical boiler, 3 feet high and 15 inches in diameter, shell being $1/4$ inch thick, with flat heads $3/4$ inch thick, and firebox in base of boiler, with 15 tubes, as compared with a wrought iron one of similar form? A. We think the wrought iron boiler is preferable on many accounts, and advise you not to use cast iron.

(24) W. H. P. asks: Will it require less heat to boil away 100 gallons water in vacuo than under

atmospheric pressure? Would there be a decided gain in the expense of fuel in thus evaporating water? A. The amount of heat required would be a few per cent less in the case of the vacuum.

(25) A. B. says: 1. We intend to put a siphon to draw the water from a part of mines, the height to which the water has to be lifted perpendicularly is 20 feet from the summit. There is 600 feet of tunnel with a grade towards the other end of 6 inches to the 100 feet. We can extend the pipes to a depth of 35 feet, so that the discharging end will be 18 feet below the suction end. Length of pipe in all will be 700 feet. Will it work? A. It will be necessary to have an air valve at the highest point, which must be opened occasionally or may be made automatic. 2. We intend to use 3 inch gas pipe for the siphon, but the present supply of water will probably run through a $1 1/4$ inch pipe, and the water will increase in quantity. Can we regulate the siphon so that the present supply of water will run in a continual stream through the 3 inch pipe by putting a stopcock on the discharging end and keeping it open $1/4$ or $1/2$ of the time—as the supply of water varies? A. Yes.

(26) A. A. H. asks: How can I remove ink stains from fabrics, fingers, and paper without injuring the article stained? A. To remove ordinary ink (tanno-gallate of iron) stains, the following treatment is recommended: In many cases lemon juice will often prove efficacious. If this fails, try an aqueous solution of oxalic acid (1 part to 2 parts water) and rub well with a soft cloth. Or use a solution of chloride of tin (1 part to 3 parts water, or pure dilute muriatic acid (1 part to 10 parts water). Apply with a camel's hair brush, and then wash in cold water. Where the colors of the fabric are affected by the above treatment, moisten the spots with fresh milk and cover with fine salt. This should be done before washing. If the fabric is fine and delicate, the stained portions may be dipped in melted tallow and then pressed for some time between layers of warm pipeclay. Stains of indelible ink (made from nitrate of silver) may be removed by moistening them with a brush dipped in a strong aqueous solution of cyanide of potassium, and then well washing the fabric in water. The cyanide solution is very poisonous.

How can I gild book covers, picture frames, etc.? A. Fine gold leaf is used for ornamenting books. It is stamped in the covers by a press. On gilt picture frames gold leaf is also used, but in many instances the gold-like finish on these frames is produced by laying on first silver leaf, and then lacquering this with an alcoholic solution of orange shellac, to which is often added gum sandarac and dragon's blood, saffron, gamboge, etc.

(27) J. W. S. says: Can you give me a good formula for making a fluid extract of annatto? A. Annatto is often adulterated with flour, soap, Venetian red, and red lead. Macerate it with twice its weight of alcohol for several hours and filter.

Please tell me how to make a good stencil ink, which contains no oily matter and will dry quickly? A. Rub up a quantity of lampblack in a mortar with enough of a strong, hot solution of dextrin in water to form a paste, and add a little alum water. Solution of soap is sometimes used in place of the dextrin and water.

(28) J. R. K. asks: By what process can I remove the silver from old mirror backs, so that it can be used again? A. If it is silvered, use nitric acid, and crystallize from the solution by evaporation in a small porcelain vessel. If the coating is an amalgam of tin and mercury, use mercury, and loosen the film by rubbing with a cloth.

I have some walnut furniture finished in shellac. It got wet in moving; and wherever the water touched it, it left a white spot. How can I remedy this? A. Rub the spots with a little oil mixed with Venice turpentine.

Is arsenite of copper called Paris green? A. No. Arsenite of copper is known as Scheele's green; Paris green is an aceto-arsenite of copper.

(29) G. J. H. asks: Is there any way to separate tin and copper which have been melted together, so that the copper can be used again? A. Most of the tin may be burned out by prolonged exposure to the air at a high temperature. This is the only practical method we know of. Small quantities of the alloy may be dissolved in a slight excess of strong nitric acid. The insoluble oxide of tin will then settle to bottom of the vessel, when the copper solution may be decanted and the copper precipitated out as oxide with an excess of potassa, soda, or lime. This precipitate may be reconverted into metallic copper by first drying it thoroughly, and then mixing it in a crucible with powdered charcoal, and exposing to a high temperature. The tin may be recovered in a similar way.

(30) W. B. M. says: I want to build a tank 48 inches deep by 48 inches wide by 36 inches long, for boiling linseed oil with steam. What amount of pipe will be required to dissolve the manganese used in boiling that amount of oil? A. This can best be determined by experiment. It may require 150 to 200 feet of inch pipe, but this, of course, is dependent on the temperature attained and the length of time allowed for the operation. There are no accurate data on the subject.

(31) W. B. asks: Is there any possible way to get the turpentine taste out of rosin? A. Pulverize the rosin and boil it for some time with a quantity of water; then dry, and fuse it.

(32) O. E. says: I will advise R. L. D., who asks how to harden an eggshell, to lay the egg in vinegar for two weeks. The shell becomes soft, and you can stretch it like a piece of rubber. Lay it in a strong solution of saltpeter for two weeks, and then you cannot strike it to pieces with a hammer.

(33) A. J. J. asks: How can I make an indelible mixture of nitrate of silver, using oil? A. You may make an emulsion of the nitrate in the oil by rubbing them up together in a mortar. It is better to use glycerin instead of oil. Mordant with a strong solution of carbonate of soda.

(34) H. E. W. asks: 1. In the manufacture of electric annunciators, will malleable iron castings answer as well for frames for the magnets, etc., as brass castings? A. Yes. 2. If the magnet cores are screwed

directly to the malleable iron frame, without a connecting piece of iron, will it answer as well, the malleable iron acting as the connecting piece? A. Yes. Which is cheaper, to cast small articles in brass, or to cut them with dies? A. Castings will probably be found cheaper.

(35) W. P. E. asks: 1. Have you any knowledge of a speed of 25,000 revolutions per minute having been obtained by a single motion, without gearing of any kind? A. We do not remember having seen or heard of such a device. 2. Could such a speed be advantageously applied, for instance in blowing a steam fog horn for the Signal Service, or for other purposes, provided the machine giving the motion was not too expensive? A. It might be usefully applied to numerous cases, if cheap, simple, and powerful.

(36) A. M. W. says, in reply to D. W.'s query as to his singular phenomenon: This does not appear to me at all singular. It is very evident that the bearing, or step, had become dry. It is a common occurrence, where steel runs in or on steel, that the bearing will, if allowed to get dry, become heated to such a degree that the temper is lost, and the surfaces get to cutting and almost weld together. The statement that the plate was bent by the hammer shows that the plate was soft then, even if it had once been hardened. D. W. says that sufficient oil was found above the plate collar, but he does not say that there was oil on the plate where it was most needed. In my experience, I have never known hardened steel to cut or grind together when properly lubricated, and I think it impossible to produce that effect except by a pressure that would expel every particle of the lubricant. Two hardened steel surfaces may be ground together when dry without losing the temper; but they would not adhere with the tenacity that D. W. describes. It is possible that the time taken to raise both stones gave the spindle and plate opportunity to give off the heat to the cast foot and bed. In my opinion, the construction of the oval end spindle would have a tendency to run dry even under common lubrication, as it would only bear on a small part of the end, which might, with the weight of the stone, force it dry. Hardened steel bearings do not often give any notice of being dry, except by refusing to do duty, a very few revolutions being sufficient to announce the fact and ruin the bearing. I would suggest to D. W. that he make his spindle so that its end rests its whole surface on the step with a hole in the latter opposite the center of the spindle. The spindle should be made like a cup, so as to form a reservoir for the oil, and so deep that the end of the spindle shall be immersed.

(37) J. S. B. says: I have found a specimen of tantalite. Can you tell me anything about this rare mineral? It is said to consist of tantalum acid and iron, and is valuable, especially when found in crystallized forms. May we expect to find it in veins or beds, or on high or low lands? A. Tantalite is FeO, MnO, TaO₂, with sometimes oxide of tin replacing part of the ferrous oxide. Some specimens are nearly destitute of manganese and some contain oxide of copper and lime. Its luster is nearly pure metallic, somewhat adamantine; its color is iron black, and streak reddish brown to black. It is opaque and brittle, and its hardness varies from 6 to 6.5. Its specific gravity is from 7 to 8. It is confined mostly to albite or oligoclase granite, and is usually associated with beryl. It is also found associated with giantolite in albite granite, and with lepidolite, black tourmaline, and colorless beryl. The name is usually extended to the American mineral columbite, the average analysis of which gives SiO₂ (80.60), FeO (15.57), MnO (5.0), SnO₂ (a trace).

(38) T. McC. says: 1. I am building a small horizontal steam engine, with 2 inches bore and 4 inches stroke. What size of boiler would I need for it, and what should be the thickness of the iron? A. Make it 15 inches in diameter, 24 inches high, of 3/4 inch iron, for 60 lbs. pressure. 2. What would be the best speed to run it at in order to get the most power? A. You may run it at 250 revolutions a minute. 3. Could I make a cylinder of an engine with 2 inches bore and 4 inches stroke with Babbitt metal, that would stand the steam pressure as well as brass or iron? A. No.

(39) H. P. S. says, in reply to A. B.'s questions as to the violin: There are two or three different tools with which the grooves are cut. One of the best I ever used or saw, I constructed myself; but it cannot well be described in a limited space or without illustrations. With it a perfect groove can be cut around a violin plate in half an hour. A perfect groove cannot be made without a tool well adapted to the purpose. The threads mentioned by A. B. are known as purfling, and consist of a thin slip of white holly wood between two similar slips of ebony, and are glued into the groove before the plate receives its final finish. Staining is, in most cases, done upon the wood, with thin, transparent dyes of different composition, and varnish laid on over that in the ordinary manner; but the technicalities of this portion of the subject are too numerous for treatment in brief space. See Business and Personal column of this issue.

(40) D. H. M. says, in reply to D. W.'s query as to the welding of his mill spindle: I suggest that the mill had been in use long enough to wear the lower end of the spindle to such a nice fit on the step that no oil could get under it, which caused friction sufficient to produce heat enough to weld it, and as it was done suddenly, the heat did not extend far in either direction, and the cold metal in connection with it soon cooled it down again. While the oil that it was covered with answered in the place of borax or other welding preparation, and at the same time excluded the atmosphere so that no change of color of the heated parts took place. I have seen a hardened steel gudgeon that was in the lower end of a water wheel shaft welded to the step when it was three feet under water. The force of the wheel twisted it off a little above where it was welded; and when it was taken out the piece could not be knocked off the step with a sledge hammer.

(41) R. L. C. says, in reply to D. W.'s query as to the millstone spindle and step: I have repaired two mill spindles that have had their points ground or welded to the steel plates upon which they run. In one case the steel point was 1 1/2 inches in diameter, and projected from the spindle (which was 4 inches

in diameter) about 3 1/2 inches. It was twisted off about 1 1/2 inches from the end, and the parts were to all appearance thoroughly welded together. In the second case, the point was of about the same dimensions as the first; but instead of twisting the point off, it turned in the spindle (which of course cut it badly), where it stuck to the plate. After considerable hammering, they were broken apart, but not where they were welded, as part of the plate came away with the point when they separated. I account for it in this way: As long as two metal surfaces that are intended to run together are properly lubricated, we have no grinding or welding if they are proportioned to the work they have to do. In the above cases, the person in charge of them said there was plenty of oil in the pots. It often happens that the passage ways get stopped up and the oil fails to reach the parts, and the result is that they grind together almost instantly.

(42) M. D. L. says: We desire to manufacture for our own use in large quantities, carbon plates for batteries, and carbons for electric lamps, of larger size and greater length than we can find in the market. What mixture of materials secures best results? What degree of compression is required? How is compression applied? Should the mixture be heated while under compression? What kind of mould is used? How can we prevent the carbon from adhering to sides of mould? A. In his work on "Electricity and the Electric Telegraph," Prescott says: "The fine dust of coke and coking coal is first put into a close iron mould of the shape required for the carbon and exposed to the heat of the furnace. When taken out, the burned mass is porous and unfit for use, but by repeatedly soaking it in thick syrup of gas tar and reheating it, it at length acquires the necessary solidity and conducting power."

(43) R. J. J. asks: How can I make a galvanic machine for giving shocks from the wire of the telegraph sounder? A. You can get a pretty strong shock from an ordinary telegraph relay, if you have one, and do not want to incur the expense of a special apparatus. The connections are made in the following manner: The relay is joined up in circuit with a battery and mechanical vibrator for interrupting the circuit, and two wires with handles, to be held when taking the shock, are connected to the binding screws of the relay's helices, one wire to each screw.

(44) H. A. H. says: I have a glass jar, about two feet of insulated wire, some blue vitriol and some sulphate of zinc. Please tell me what more I want to make a battery with? A. Get a copper plate, attach the wire to it, and place it on the bottom of the jar with the wire sticking out. Fill the jar about two thirds full with a weak solution of sulphate of zinc and water, and suspend a zinc casting, provided with a terminal wire, from the top of the jar; let the zinc just dip below the surface of the solution. Now drop a few crystals of blue vitriol on the copper plate and join the wires for a short time, when the battery will be ready for action.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the result stated:

Will J. M. P. send us a specimen of the residue from his limestone water?—G. S. A.—The piece of rock contains titaniferous iron. It would require a quantitative analysis to determine all of the other constituents. It also contains a little arkanite—titanic acid. The pieces of metal consist apparently of the iron from your ladle, together with some titanic acid.—J. Z.—So far as we can discover, the sear contains only very strong tobacco. The odor is due to certain essential oils peculiar to tobacco, and cannot well be imitated.—G. H. P.—It is a variety of mica called muscovite, consisting of potash, alumina, and silicic acid. It is not valuable.—B. F. C.—It consists principally of carbonate of soda. We do not see that it would be likely to prove very efficacious as a scale preventive. It will not injure the iron.—We have received some minerals in a small pasteboard box without a name on it. No. 1 is chlorite, composed of oxide of iron, magnesia, alumina, and silica. No. 2 is chondrodite—a silicate and fluoride of magnesium. No. 3 is spinel—magnesia and alumina.

D. F. H. asks: How is the tubing of brass band instruments formed, and how are the dents removed from the same?—D. S. says: I have made a few wooden organ pipes, but they do not give more than a whistling sound. Can any one give me the proportions for a middle C?

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On Spiral Springs. By J. T. G.
On Man's History. By J. E. W.
On Mechanical Science. By E. B.
On Kerosene Oil for the Hair. By G. H. S.
On the Origin of Solar Light. By G. P. H.
On Canceling Postage Stamps. By H. D. M.
Also inquiries and answers from the following:
H. P. G.—S. T. A.—G. H.—W. B.—P. M. G.—J. M.—X. Y. Z.—J. D. H.—W. W.—P. C.—H. R.—G. McC.

HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Inquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of inquiries analogous to the following are sent: "Who sells square lenses for magic lanterns? Who sells telegraph instruments for learners? Who is the best theodolite? Who sells the best aniline dyes? Why do not makers of steam plows advertise in the SCIENTIFIC AMERICAN?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

OFFICIAL. INDEX OF INVENTIONS FOR WHICH Letters Patent of the United States were Granted in the Week Ending April 10, 1877, AND EACH BEARING THAT DATE. (Those marked (r) are reissued patents.)

A complete copy of any patent in the annexed list, including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

Amalgamating ores, Laffin & Elliott	189,313
Animal trap, M. Early	189,346
Anti-friction bearing, O. R. Chaplin	189,427
Anvil, blacksmith's, H. B. Severy	189,383
Axle box, D. Dalsell	189,434
Bale band tightener, J. L. Sheppard	189,325
Bale ties, etc., cutting, J. B. Tobin	189,524
Barrels, etc., lining, M. Laffin	189,312
Barrels compressing, O. D. Goodell	189,309
Bed bottom, spring, F. B. Franklin (r)	7,597
Bed bottom, spring, J. H. Palmer	189,382
Bedstead, wardrobe, M. Crosby	189,306
Beer, ale, etc., cooler for, F. V. Baudelot	189,331
Beer cooler, F. V. Baudelot	189,332
Belt fastener, P. Lyons	189,478
Bench plane, L. Bailey	189,415
Bench plane, G. Gocher	189,433
Bevel, J. F. Klingensmith	189,311
Blackboard, Kinsley & Packard	189,473
Boiler tube stop plug, M. Coryell	189,429
Boot and shoe, J. M. Robbins	189,353
Boot and shoe, J. Fleming	189,444
Boot and shoe heel, M. A. Myers	189,487
Boot and shoe last, Batley, Keats & Nell	189,418
Boot jack, J. Buzzell	189,386
Boot safety sole, Watson & Crane	189,408
Breech loading ordinance, F. M. Swallow	189,329
Bridge attachment, S. S. Cummings	189,341
Broiler, C. D. Symonds	189,519
Butter and fruit jar, C. A. Sands	189,390
Button fastening, G. W. Beeley	189,419
Car brake, L. T. Hay	189,457
Car coupling, A. T. Bigalow	189,334
Car coupling, J. B. Zink	189,540
Car starter, R. Hermance	189,458
Carburetor, J. J. Paquette	189,490
Carriage top and seat rail, J. W. Post	189,385
Casting pipes, core for, J. Pennycook	189,492
Chandeller, F. S. Shirley	189,509
Chuck for pipe fittings, J. Flower	189,445
Churn dasher, F. M. Johnson	189,469
Churn dasher, J. L. Maxwell	189,372
Clasp for skirt supporters, E. C. Fales	189,442
Coffin handle, F. X. Gartland	189,443
Coin, box for holding, C. E. McConnell	189,482
Coloring matters from aniline, Wolf & Betley	189,538
Cooking utensil, S. Spoor (r)	7,602
Corn harvester, W. H. & J. L. Cox	189,430
Corn planter, J. Leitch	189,515
Corset, M. Cohn (r)	7,596
Corset, I. D. V. Warner	189,405
Cotton chopper, J. B. Eaves	189,341
Cotton picker, O. R. Smith	189,396
Crayon for marking glass, etc., B. J. Clarke	189,338
Crockery, ornamenting, E. J. Gerard	189,450
Cultivator, J. C. Stevens	189,513
Cylinders, etc., polishing, M. H. McNair	189,483
Dental engine, G. W. Tripp	189,526
Dental engine, B. M. Wilkerson	189,409
Dish warmer, J. H. Wright	189,412
Ditching machine, S. P. Evans	189,440
Ditching machine, T. T. Fleener	189,350
Ditching machine, Slaton & Wadlington	189,365
Door bell, W. E. Sparks	189,397
Door bolt, R. Eichmuller	189,438
Drawbridge, R. C. Moundson	189,320
Eave trough cover, J. R. Creighton	189,431
Electroplating wire, Wallace & Smith	189,533
Engraved plates, etc., polishing, R. Neale	189,377
Exercising machine, Hansom & Russell	189,356
Exercising machine, G. W. Wood	189,339
Eyeglass, J. S. Spencer	189,511
Fan attachment, Thompson & Bergstrom	189,523
Fats, rendering, W. E. Andrew	189,541
Feed cutter, J. R. Whittemore (r)	7,605
Fence, iron, Root & Strickland	189,323
Fence, iron, J. H. Van Dorn	189,543
Fence post, W. B. Markham	189,480
Filter, liquid, M. Lansburgh	189,334
Fire arms, lock for, I. Robbins	189,387
Fire arms, wiper for, J. T. Hamilton	189,455
Fire kindler, C. H. Hayden	189,310
Flour cupboard and knead board, F. M. Mahan	189,479
Fly fan, J. F. McMillen	189,373
Fly fan, G. W. J. Wolts	189,337
Fly wheels, etc., balancing, C. Seymour	189,506
Fruit drier, J. M. Keeler	189,472
Fruit jar, J. L. Mason	189,316
Fuel, artificial, J. Q. A. Ziegler	189,413
Furnace, heating gas, P. W. Mackenzie	189,367
Gaiter, C. Libby	189,476
Gas meter, register, etc., J. J. Squire (r)	7,601
Gate, automatic, T. E. Breaker	189,500
Glassware manufacture of, W. Fox	189,351
Grain drill, C. E. Patrie	189,383
Grinding hollow ware, etc., W. Scully	189,505
Grinding machine, S. Bevan (r)	7,595
Grinding mill, J. Mellinger	189,484
Hammer, riveting, E. Wright	189,411
Handles, attaching, F. G. & W. F. Neldringhaus	189,378
Harness breast collar, W. Gibbs	189,308
Harness pad, M. V. Longworth	189,365
Hides and skins, treating, N. Wilson	189,536
Hitching post, W. N. Hutchinson	189,464
Hop drier, C. A. Sands	189,389
Hop press, J. Jakel	189,465
Horse hay rake, L. Myers (r)	7,599
Horse power, traction, D. T. Gillis	189,354
Horse protector, W. S. Marsh	189,369
Horsehoe machine, W. Roberts	189,322
Hose nozzle, J. H. Stump	189,328
Hot water apparatus, E. Lawler	189,314
Hub cap and axle nut, A. R. Cushman	189,433
Hub, elastic, G. W. Hayes	189,357
Hub, elastic, Sammis & Hayes	189,388
Hub, metallic, C. E. Owen	189,409
Hub runner, G. F. Kimball	189,362
Hydraulic elevator, E. Brewer	189,424
Hydraulic engine, C. D. Page	189,380
Hydrocarbon burner, J. Bishop	189,421
Ice ax, W. H. Coleman	189,329
Ice machine, S. Trugheim	189,325
Key and knob fastener, W. Nerncher (r)	7,600
Key for locks, J. Schade	189,508
Key for locks, W. H. Taylor	189,521

Keys, stock for the manufacture of, W. H. Taylor	189,339
Knitting needles, L. E. Salisbury	189,500, 189,501, 189,502
Lamp burner, Hallas & Weeden	189,542
Lamp chimney, H. L. Ives	189,389
Lamp extinguisher, E. C. Hakeslee	189,325
Lamp, fountain, E. J. Stearns	189,398
Lamp, street and park, J. Stimpson	189,514
Lamps, lighting night, J. R. Rowlands	189,499
Leather cutting die, A. Warren	189,406
Life boat, sectional, G. Bates	189,297
Lifting jack, A. R. Hurst	189,463
Lifting jack, V. Johnson	189,468
Lightning rod coupling, L. Bradley	189,299
Lightning rods for oil tanks, J. A. Sheriff	189,326
Liquid measure, S. R. Dummer	189,345
Look for sliding doors, etc., J. W. Schoonmaker	189,362
Lock, strap, B. Kane	189,361
Loom, circular, J. E. Gillespie	189,533
Loom, gimp, R. Stone	189,515
Lumber dryer, J. J. Curran	189,432
Magazine cane gun, M. Dalgie	189,305
Milk cooler, B. D. Miller	189,435
Moistening pad, C. E. Stockder	189,517
Monument, A. Smith	189,297
Music, electro-pneumatic, W. F. Schmoelle et al.	189,301
Nail plates, pile for, W. H. Powell	189,495
Nozzle and sprinkler, N. Malmquist	189,368
Nutmeg grater, J. Meyer	189,375
Oven, portable, E. V. Van De Mark	189,433
Packing demijohns, etc., G. W. Peck	189,491
Pantaloon, shaping, E. B. Viets, (r)	7,603
Paper bag, A. S. Dennison	189,342
Paper box, A. Goldback	189,454
Pavement, stone, B. F. Camp	189,337
Pen, fountain, A. T. Cross	189,504
Petroleum products, etc., H. W. C. Tweedie	189,401, 189,402
Photographic burnisher, J. H. Ferguson	189,348
Pianos, hollow support for, J. Fairman	189,441
Pipe coupling, S. Lightburne, Jr.	189,477
Plow, D. P. Ferguson	189,443
Plow, J. C. Jenkins	189,466
Plow, J. Reich	189,496
Printing press, J. Wade	189,522
Pump, W. S. Davis	189,306
Pump bucket, chain, W. Cooper	189,428
Pump, steam, C. Ahrens	189,414
Pump, suction and force, T. B. Swan	189,518
Pump pipe joint, etc., J. B. Eads	189,496
Railway gate, Fox & Vorwald	189,447
Railway joint, Palm & Fitzgerald	189,381
Railway rails, bending, W. R. Jones	189,471
Reverberatory furnace, J. Morrison	189,426
Revolving firearm, O. Jones	189,300
Road scraper, P. Schneider, Sr.	189,324
Safety pin shield, W. A. Butler	189,435
Sap spout, E. Willis	189,330
Sash balance, B. S. McCune	189,317
Saw grinder, E. P. Terrell	189,322
Saw gulpe, adjustable, G. W. Baker	189,416
Saw mills, log turner for, J. Orm	189,379
Saw, scroll, J. A. House	189,461
Saw sharpener, J. Walsh	189,534
Sawing machine, M. Rose	189,498
Sawing machine, scroll, G. H. Truxell	189,527
Scales, platform, H. T. Lawton	189,475
Scrubbing machine, P. Byrne, Jr.	189,426
Seed planter, J. Wafer	189,404
Seeder and cultivator, W. A. Van Brunt (r)	7,604
Seeder and fertilizer, O. Stone	189,516
Sewing machine shuttle, W. Bown	189,420
Sewing extension table, H. G. Crawford	189,438
Sewing machine take-up, J. L. Follett	189,446
Shavings, grinding, I. & A. G. Tompkins	189,399
Shell, B. B. Hotchkiss	189,328
Shot cartridge, H. H. Barnard	189,417
Show case, W. T. Sherer	189,509
Skate, roller, R. Gibson	189,451
Spelling, teaching, D. A. Willbanks	189,535
Steam pipe covering, P. Carey	189,301
Steam radiator, R. S. Gillespie	189,423
Steam tank for cooking in cans, F. M. Warren	189,407
Steaming fabrics, etc., W. Mather	189,371
Still, T. Gaff	189,448
Stirrup, H. H. Knight	189,363
Stop cock lock, H. C. Meyer & Co. (r)	7,598
Stove castor frame, E. H. Voorhees	189,531
Stove drum, Vosburgh & Van Slyke	189,530
Stoves, zinc board for, E. Jones	189,470
Sugar, clarifying, J. Schwartz	189,504
Suspenders, J. R. Pollock	189,494
Suspenders, A. Shenfield	189,294
Target, W. H. H. Norcross	189,321
Target, spherical glass, A. H. Bogardus	189,422
Tea kettle, J. Reising	189,497
Telescope ballast tube, A. Berghold	189,420
Thrashing machine, concave, J. H. Sharp	189,507
Three horse equalizer, E. B. Decker	189,433
Tobacco pail cover, F. A. Braymer, Jr.	189,299
Tobacco stem flattener, N. H. Borgfeldt	189,296
Toe calks, making, H. C. Field	189,549
Trunk, etc., H. F. Worthington	189,410
Turbine, Osborn & Lybarger	189,488
Tuyere machine, J. E. Atwood	189,295
Umbrella runner, T. G. Hojer	189,460
Valve, balanced, W. Stephens	189,512
Valve, circular, H. L. Tully	189,430
Valve, steam pump, J. W. Mathieson	189,370
Valve, safety, I. M. Phelps	189,435
Vehicle hub and box, G. W. Eldridge	189,439
Vehicle hubs, cap for, E. G. Edgley	189,437
Vehicle spring, J. W. Groat	189,385
Vehicle wheel, J. McGowan	189,318
Ventilator, Harold & Satterlee	189,456
Ventilator, P. Mihan	189,376
Vessels, construction of, N. G. Herreshoff	189,439
Wagon bed, R. B. Hunt	189,462
Wagon box strap bolt, J. Jensen	189,407
Wagon tongue support, R. Dudley	189,244
Washer and amalgamator, B. Tyson	189,328
Washing machine, S. L. Denney	189,343
Washing machine, E. McBride	189,481
Washing machine, D. Miller	189,319
Watch roller abstractor, B. Freese	189,307
Weed hider, McDowell, Thorn & Ewing	189,374
Wheel tire, L. N. Fyle	189,396
Whistletree attachment, J. D. Lane	189,474
Windmill, G. R. Comstock	189,302
Window sash, J. Petri	189,384
Wire fabric, H. R. Van Eps	189,529
Wooden rods, etc., making, Smith & Saltar	189,513
Wrench, J. B. Fox	189,320
Wrench, J. D. Lovell, administrator of, A. G. Coes	189,320

THE TRUANT BOYS: A more ingenious picture than the last. Toll-gate. Sent free for stamp. E. C. Abbey, Buffalo, N. Y.

Advertisements.

Inside Page, each insertion --- 75 cents a line.
Back Page, each insertion --- \$1.00 a line.
Engravings may head advertisements at the same rate per line, by measurement, as the letter press. Advertisements must be received at publication office as early as Friday morning to appear in next issue.

GUARDIOLA'S COFFEE & SUGAR MACHINERY

Coffee, Malt, Corn, Cocoa, and Grain-Drying Machine, Coffee-Hulling and Polishing Machine, Coffee-Washing Machine, Helix Sugar Evaporator.

Messrs. C. ADOLPHE LOW & CO., 42 Cedar Street, New York, are Mr. Guardiola's Agents, and they will give prompt attention to all orders for any of the above machines.



Best Tempered Cast Steel.
Retail Price, 9 Cents per lb.
WARRANTED. 15" Send for Circular.
Fisher & Norris, Trenton, N. J.

MACHINISTS' TOOLS.

NEW AND IMPROVED PATTERNS.
Send for new illustrated catalogue.

Lathes, Planers, Drills, &c.
NEW HAVEN MANUFACTURING CO.,
New Haven, Conn.

PETTENCILL'S NEWSPAPER DIRECTORY AND ADVERTISERS' HAND-BOOK FOR 1877.

PRICE, - - ONE DOLLAR.

Containing complete lists of American Newspapers and other periodicals, with such details of information as are most useful to advertisers and business men.
The book contains 376 pages, and is the most complete and convenient work of the kind ever published. It will be sent to any address, postpaid, upon receipt of the very low price of one dollar per copy.

S. M. PETTENCILL & CO.,
PUBLISHERS,
37 Park Row, New York.



[ESTABLISHED 1846.]

Munn & Co's Patent Offices.

The Oldest Agency for soliciting Patents in the United States.

THIRTY YEARS' EXPERIENCE.

MORE PATENTS have been secured through this agency, at home and abroad, than through any other in the world.

They employ as their assistants a corps of the most experienced men as examiners, specification writers, and draughtsmen, that can be found, many of whom have been selected from the ranks of the Patent Office.

SIXTY THOUSAND inventors have availed themselves of Munn & Co.'s services in examining their inventions and procuring their patents.

MUNN & CO., in connection with the publication of the SCIENTIFIC AMERICAN, continue to examine inventions, confer with inventors, prepare drawings, specifications, and assignments, attend to filing applications in the Patent Office, paying the Government fees, and watch each case, step by step, while pending before the examiner. This is done through their branch office, corner F and 7th Sts., Washington. They also prepare and file caveats, procure design patents, trade marks, and releases, attend to rejected cases (prepared by the inventor or other attorneys), procure copyrights, attend to interference, give written opinions on matters of infringement, furnish copies of patents, and, in fact, attend to every branch of patent business, both in this and in foreign countries.

A special notice is made in the SCIENTIFIC AMERICAN of all inventions patented through this agency, with the name and residence of the patentee. Patents are often sold, in part or whole, to persons attracted to the invention by such notice.

Patents obtained in Canada, England, France, Belgium, Germany, Russia, Prussia, Spain, Portugal, the British Colonies, and all other countries where patents are granted, at prices greatly reduced from former rates. Send for pamphlet pertaining specially to foreign patents, which states the cost, time granted, and the requirements for each country.

Copies of Patents.

Persons desiring any patent issued from 1836 to November 26, 1867, can be supplied with official copies at reasonable cost, the price depending upon the extent of drawings and length of specifications.

Any patent issued since November 27, 1867, at which time the Patent Office commenced printing the drawings and specifications, may be had by remitting to this office \$1.

A copy of the claims of any patent issued since 1836 will be furnished for \$1.

When ordering copies, please to remit for the same as above, and state name of patentee, title of invention, and date of patent.

A pamphlet, containing full directions for obtaining United States patents, sent free. A handsomely bound Reference Book, gift edges, contains 140 pages and many engravings and tables important to every patentee and mechanic, and is a useful handbook of reference for everybody. Price 75 cents, mailed free.

Address

MUNN & CO.,
Publishers SCIENTIFIC AMERICAN,
37 Park Row, N. Y.

BRANCH OFFICE—Corner of F and 7th Streets, Washington, D. C.

NOYE'S MILL FURNISHING WORKS

are the largest in the United States. They make Burr Millstones, Portable Mills, Smut Machines, Packers, Mill Picks, Water Wheels, Pulleys and Gearing, specially adapted to flour mills. Send for Catalogue.
J. T. NOYE & SON, Buffalo, N. Y.

FOR SALE—A 25-HORSE POWER HARRISON Boiler, nearly new, by JAMES BINNS, Iron Founder, 27 Walworth St., Brooklyn, N. Y.

ESTABLISHED 1841.

JOSEPH C. TODD,
(Formerly of Todd & Son, N. Y.), ENGINEER and MACHINIST. Flax, Hemp, Jute, etc., Ope, Oakum, and Bagging Machinery, Steam Engines, Boilers, etc. Also Agent for the celebrated and improved Rawson & Rittinger Hoisting Engine, I will furnish specifications and estimates for all kinds of machinery. Send for descriptive circular and price. Address
J. C. TODD,
10 Barclay St., New York, or Paterson, N. J.

JOS. G. ROGERS & CO., MADISON, IND.,
wish to place a consignment of their Tannate of Soda BOILER SCALE PREVENTIVE in all important towns in the United States, to be sold on commission. Applications solicited. Send for book on Boiler Incrustation.

NON-COMBUSTIBLE STEAM BOILER AND PIPE COVERING

WITH "AIR SPACE" IMPROVEMENT.
Saves 10 to 20 per cent. CHALMERS SPENCE CO.,
Foot E 9th St. N. Y.; 132 N. 2d St. St. Louis, Mo.

HARTFORD STEAM BOILER Inspection & Insurance COMPANY.

W. B. FRANKLIN, V. Pres't. J. M. ALLEN, Pres't.
I. B. PIERCE, Sec'y.

\$5 to \$20 per day at home. Samples worth \$5 free. STINSON & CO., Portland, Me.

STEAM PUMPS
Wright's Pat. Bucket Plungers are the best. VALLEY MACHINE CO., Easthampton, Mass.

PERFECT NEWSPAPER FILE

The Koch Patent File, for preserving newspapers, magazines, and pamphlets, has been recently improved and price reduced. Subscribers to the SCIENTIFIC AMERICAN and SCIENTIFIC AMERICAN SUPPLEMENT can be supplied for the low price of \$1.50 by mail, or \$1.25 at the office of this paper. Heavy board sides; inscription "SCIENTIFIC AMERICAN" in gilt. Necessary for every one who wishes to preserve the paper.

Address
MUNN & CO.,
Publishers SCIENTIFIC AMERICAN.

SNYDER'S LITTLE GIANT STEAM ENGINE
The Best SMALL POWER ENGINES IN THE COUNTRY.
WARD B. SNYDER, 24 Fulton St., New York.
One-Horse Power, with tubular boiler complete, only \$150.
Two-Horse Power... 200.
Three-Horse Power... 250.
Call and Examine, OR SEND FOR CATALOGUE.

MACHINERY OF IMPROVED STYLES FOR MAKING SHINGLES, HEADING AND STAVES; also GAUGE LATHES FOR TURNING HANDLES. Sole makers of Law's Pat. Shingle and Heading Sawing Machine. Address **TREVOR & CO.,** Lockport, N. Y.

Local and Traveling Agents Wanted in every State and Territory in the Union, to sell Mechanical Goods. Liberal commission offered. Prompt replies desired, and full details. Address "MORGAN," Box 264, N. Y.

GUILD & GARRISON,
34 to 44 First St.,
Williamsburgh, N. Y.,
Manufacturers of
STEAM PUMPS
for all purposes.
Also Vacuum Pumps,
Vacuum Pans, and
Air Compressors.

LeCOUT'S PATENT Machinists' Tools.

REDUCED PRICES.
Set Iron Dogs, 3-8 to 2 in., \$5.00
" " 2-8 to 4 in., 12.00
" Steel " 3-8 to 2 in., 6.50
" " 2-8 to 4 in., 13.00
Iron & Steel Clamps, Die Dogs, Clamp Dogs, Vice Clamps, Expanding Mandrels, &c. Send for latest Price List to C. W. LE COUT, South Norwalk, Conn.

DAMPER REGULATORS BEST AND LEVERS GAUGE COCKS.
MURRILL & KEIZER, 41 HOLLIDAY ST., BALTIMORE.

The Double Eccentric Cornice Brake.
Patented 1873. In use throughout the U. S. and Canada. For Illustrated Circular, prices, etc., address J. M. ROBINSON & CO., successors to Thomas & Robinson, Cincinnati, O.

Incombustible Mineral Wool

The best and cheapest insulator of heat or cold. Send for circulars, 20¢ Brochure, New York.
ALEXANDER D. ELBERS,
P. O. Box 481.

\$3 WATCHES. Cheapest in the known world. Strong, smooth and reliable. For terms address **COULTER & CO.,** Chicago.

WIRE ROPE

Address **JOHN A. BOERLING'S SONS,** Manufacturers, Trenton, N. J., or 111 Liberty Street, New York. Wheels and Ropes for conveying power long distances. Send for circular.

Niagara Steam Pump Works.
ESTABLISHED 1820.
CHARLES B. HARDICK,
No. 23 Adams Street,
BROOKLYN, N. Y.

KNOWLES' STEAM PUMP WORKS,
92 & 94 Liberty St., New York.
Great reduction in prices. Send for catalogue. The "Knowles" has always been the best steam pump made.

ROCK DRILLING MACHINES AND AIR COMPRESSORS.
MANUFACTURED BY **BURLEIGH ROCK DRILL CO.,**
SEND FOR PAMPHLET. FITCHBURG MASS.

Type and Printing Materials FOR SALE.

The following Fonts of Type, in good condition, having been but little used:
Brevier, on Long Primer Body, about 500 lbs.
Brevier, 100 lbs.
Nonpareil, on Brevier Body, 300 lbs.
Agate, 250 lbs.
Sixteen Cases Job Type, in Cabinet.
All the above are Copper-faced.
Leads, Brass Rules, etc.
Cases, 44 pairs.
Column Gallies, brass bottomed, 6.
Chases, wrought iron, 2 pairs, 36x24 inches.
Composing Frames, 4.
Racks, 2.
Imposing Stones, one 75x30 inches, one 72x30, both on stands with drawers.
Roller Press.
The above were used on the SCIENTIFIC AMERICAN, and are in clean and perfect condition. The room in which the above is deposited is wanted for other purposes on the first of May, and the lot will be sold very cheap. Apply at the office SCIENTIFIC AMERICAN, 37 Park Row, N. Y., for further particulars.

EAGLE FOOT LATHES,
Improvement in style. Reduction in prices April 20th. Small Engine Lathes, Slide Rests, Tools, etc. Also Scroll and Circular Saw Attachments, Hand Planers, etc. Send for Catalogue of outfits for Amateurs or Artisans.
WM. L. CHASE & CO.,
95 & 97 Liberty St., New York.

BOGARDUS' PATENT UNIVERSAL ECCENTRIC MILLS—For grinding Bones, Ores, Sand, Old Crucibles, Fire Clay, Guano, Oil Cake, Feed, Corn, Corn and Cob, Tobacco, Sugar, Salts, Roots, Spices, Coffee, Flaxseed, Asbestos, Mica, etc., and whatever cannot be ground by other mills. Also for Paints, Printers' Inks, Paste Blacking, etc. **JOHN W. THOMSON,** successor to JAMES BOGARDUS, corner of White and Elm Sts., New York.

\$3 PRINTING PRESS!
Prints cards, envelopes, etc., equal to any press. Larger sizes for large work. Do your own printing and advertising and save money. Excellent spare hour amusement for old or young. Or it can be made money making business anywhere. Send for stamps for large catalogue to
KELSEY & CO., Manufacturers,
Meriden, Conn.

PUNCHING PRESSES.
Drop Hammers and Dies, for working Metals, &c. **THE STILES & PARKER PRESS CO.,** Middletown, Conn.

1872, 1873, 1874, 1875, 1876, SCIENCE RECORD.

A few copies of these splendid books, copiously illustrated, are offered at the following very low prices. Persons desiring a condensed history of the most interesting Facts and Discoveries in the Arts, Sciences, and Inventions, for the years from 1872 to 1876 will find them recorded in the five volumes of the SCIENCE RECORD, now offered at half the original price.

Every Department of Science is treated in these volumes, and the important discoveries of the several years are not only faithfully described, but many of the subjects are illustrated with finely executed engravings, prepared expressly for these Annuals.

Among the subjects, the following are the most noteworthy, exhibiting in a condensed form a general account of the Progress of the World:

CHEMISTRY AND METALLURGY, MECHANICS AND ENGINEERING, ELECTRICITY, LIGHT, HEAT, SOUND, TECHNOLOGY, THE USEFUL ARTS, BOTANY AND HORTICULTURE, AGRICULTURE, DOMESTIC AND HOUSEHOLD ECONOMY, MATERIA MEDICA, THERAPEUTICS, HYGIENE, NATURAL HISTORY AND ZOOLOGY, METEOROLOGY, TERRESTRIAL PHYSICS, GEOGRAPHY, GEOLOGY AND MINERALOGY, ASTRONOMY, BIOGRAPHY AND NECROLOGY.

Each yearly volume contains about 600 octavo pages, including a large number of handsome engravings. They are bound in substantial and handsome bindings, and will be mailed on receipt of \$1.25 each, or \$5 for the set of five volumes.

They were published and heretofore sold at \$2.50 each, or \$10 for the set.

State, in remitting for a single volume, which year, from 1872 to 1876, is desired, remembering that the date of the volume covers the events and discoveries of the previous year. Send by mail on receipt of price. Address **MUNN & CO., PUBLISHERS,** 37 Park Row, New York city.

PATENT COLD ROLLED SHAFTING.

The fact that this shafting has 75 per cent. greater strength, a finer finish, and is truer to gauge, than any other in use, renders it undoubtedly the most economical. We are also the sole manufacturers of the CELEBRATED COLLINS' PAT. COUPLING, and furnish Pulleys, Hangers, etc., of the most approved styles. Price list mailed on application to **JONES & LAUGHLINS,** Try Street, 2d and 3rd Avenues, Pittsburgh, Pa. 100 S. Canal Street, Chicago, Ill., and Milwaukee, Wis. We are also the sole agents for the sale by **FULLER, DANA, & FITZ,** Boston, Mass., and **GEO. PLACE & CO.,** 121 Chambers St., N. Y.

\$5 outfit free. Salary guaranteed. Write at once to **EMPIRE NOVELTY CO.,** 30 Broadway, New York.

BUG'S IMPROVED PATENT ELEVATOR BUCKET, FOR BREWERS, FLOUR MILLS, GRAIN ELEVATORS, SUGAR REFINERS, &c.
These buckets are made of the best charcoal stamping iron, and are warranted to outlast six of the "OLD STYLE BUCKETS." The cost is about the same. Address **T. F. HOWLAND,** Brooklyn, E. D., N. Y.

Working Models
And Experimental Machinery, Metal or Wood, made to order by **J. F. WERNER,** 62 Center St., N. Y.

THE TANITE CO., STROUDSBURG, PA. EMERY WHEELS AND GRINDERS.

GEO. PLACE, 121 Chambers St., New York Agent.

BUY YOUR BOILER AND PIPE COVERING direct from the Manufacturers.
ASBESTOS FELTING CO.,
Front St., near Gouverneur, N. Y.

Pyrometers, For showing heat of Boilers, Furnaces, Super-Heated Steam, Oil Stills, &c.
HENRY W. BULKLEY, Sole Manufacturer,
140 Broadway, New York.

A. S. CAMERON'S PATENT "SPECIAL" Steam Pump
Is the Standard of Excellence at home and abroad.

REDUCED PRICE LIST.				
Number.	PRICE.	Steam Cyl.	Pump Cyl.	Stroke.
0	\$ 50	3 1/2 in.	2 in.	4
1	75	4	3	6
2	100	5	4	8
3	150	6	5	10
4	200	7	6	12
5	275	8	7	14
6	325	9	8	16
7	400	10	9	18
8	425	11	10	20
9	450	12	11	22
10	550	14	13	24
11	700	16	15	26
12	850	18	17	28

Illustrated Catalogue sent free, on application to the Inventor and Sole Manufacturer in the United States,

A. S. CAMERON,
Works, Foot of East 23d St.
NEW YORK CITY.

The HOADLEY PORTABLE STEAM ENGINE, WITH AUTOMATIC CUT-OFF REGULATOR AND BALANCED VALVE. THE BEST, MOST ECONOMICAL ENGINE MADE. SEND FOR CIRCULAR. **The J. C. HOADLEY CO., LAWRENCE, MASS.** STATE WHERE YOU SAW THIS.

The New \$20 Microscope

is fully equal to any that could have been bought three years ago for \$50. Send for descriptive circular. For the best book of practical instruction get "How to Use the Microscope," by John Phil. 75 cts. by mail. **INDUSTRIAL PUBLICATION CO.,** 176 Broadway, N. Y.

Pyrometers.

FOR Blast Furnaces, Bakers' Ovens, Boiler Flues, Superheated Steam, Oil Stills, Zinc and Lead Baths. Made under the patents of **E. BROWN,** 311 Walnut St., Philadelphia. Established 1850.

Dayton Cam Pump.

THE ONLY PUMP IN THE MARKET DESIGNED AND CONSTRUCTED ESPECIALLY FOR BOILER FEEDING. Are Pumping water at 250° F. No Dead Centers. The Steam Valve is a plain Slide Valve, identical to the slide valve of a Steam Engine, but derives its motion from a cam. Speed can be regulated to suit evaporation. Pumping Returns from Steam Heating Apparatus a specialty. Send for Circular.

Smith, Vaile & Co.,
DAYTON, OHIO.

Tube Cleaners for cleaning Boiler Tubes. THE NATIONAL STEEL TUBE CLEANER CO. 814 E. 9th St., N. Y.

TO INVENTORS AND MANUFACTURERS

FOLLOWS & BATE, Manchester, England, Hardware and Machinery Merchants, are prepared to buy American Goods for Cash, and to act as Sole Wholesale Agents.

ALLOTT LATHES, for Broom, Rake and Hoe Handles. **S. C. HILLS,** 78 Chambers St., N. Y.

DROP FORGINGS and SPECIAL MACHINERY.

THE HULL & BELDEN CO., Danbury, Conn.

F. ADEE & CO.'S PATENT LEAD STENCH TRAPS. Positive protection against sewer-gas. Best and cheapest. See illustration, SCIENTIFIC AMERICAN, April 19th. Send for circular. **F. ADEE,** 25 Pearl St., N. Y.

JOHN HOLLAND'S GOLD PENS

Received the Centennial Medal from the Judges on Awards, for "superior elasticity and general excellence." Thus sold by your Stationer, send for Discount Price List to the Manufacturer, 19 W. 4th St., Cincinnati.

SPARE THE CROTON AND SAVE THE COST. Driven or Tube Wells

furnished to large consumers of Croton and Ridgewood Water. **WM. D. ANDREWS & BRO.,** 414 Water St., N. Y., who control the patent for Green's American Driven Well.

CELEBRATED FOOT LATHES.

Foot Power Back-gear Screw Lathes, Small Hand and Power Planers for Metal, Small Gear Cutters, Slide-rests, Ball Machine for Lathes, Foot Scroll Saws, light and heavy Foot Circular Saws. Just the article for Amateurs or Artisans. Highly recommended. Send for Illustrated Catalogue. **N. H. BALDWIN,** Laconia, N. H.

THE "Scientific American" is printed with **CHAS. F. JOHNSON'S** and **CO.'S** INK. Tenth and Lombard Sts., Philadelphia, and 59 G. St., New York.