

SCIENTIFIC AMERICAN

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

Vol. XXXIII.—No. 21.
(NEW SERIES.)

NEW YORK, NOVEMBER 20, 1875.

[\$3.20 per Annum.
(POSTAGE PREPAID.)

A STRONG ROOM FOR VALUABLES.

It has been said that, no matter how much ingenuity is exercised by honest men in devising means for the protection of their valuables, there is an equal amount of inventive genius to be found among rogues, devoted to discovering ways for overcoming apparently the safest of safeguards. We have seen some burglars' implements, which have been captured by the police of this city, which show not merely skilled but highly skilled workmanship, certainly indicating that the maker might have gained large wages had he seen fit to earn his livelihood honestly. Besides manual ability, burglars, in many instances, have been proved to possess thorough scientific knowledge in the use of explosives and of the electric current; so that, all things being considered, safe makers of the present day find themselves met by weapons of offense, which compel them constantly to search for new ways of strengthening their defensive structures.

One of the largest safes that has ever been constructed, and one than which probably no stronger exists, is a banker's security room recently built by Messrs. Hobbs, Hart, & Co., the celebrated lock makers of London, the head of the firm being Mr. A. C. Hobbs, of Hartford, Conn. We give an engraving of it, extracted from the *Engineer*.

The dimensions of the room are 12 feet in height, 14 feet wide, and 7½ feet deep, embodying 476 feet of planed surface. It is constructed of sixty-two divisions, all of which are most accurately fitted, upwards of 32,000 holes having been used. The engraving shows the door open. The exterior decorations of the room are very effective, the design being a modification of that made for the jewel room constructed by the firm for Her Majesty's special use at Windsor Castle. There are 456 feet of molding, forming the panels and supporting the turleted cornice overhanging the top. It will be seen from our illustration that there are no external indications of any of the sixty-two divisions.

The construction of this room is briefly as follows: First, there is an elaborate base or false bottom formed of plates five eighths inch in thickness, on which are placed girders to support the room, forming thereby a chamber underneath the safe, designed to prevent the room from being tunneled into. The recent robberies in Baltimore in 1872, and in Russia in 1874, make such means absolutely indispensable for perfect security. The whole of this chamber is inclosed by doors, etc., and steps are formed leading to the bottom of the strong room, providing easy access into the interior. As the floor of the room stands some distance above its base, there is an arrangement of steps running on wheels, which can be drawn out opposite the door, rendering the entrance to the room perfectly easy and convenient. Standing in front of the door we find a series of locks, each having different keys to be retained by independent officers, thus providing against the risk of any single individual having access to the room without the presence of the others. Robberies having been effected abroad by drilling the outer plates of safes and strong room doors for the purpose of screwing in steel plugs, after filling the locks with gunpowder, to meet such mode of attack the locks are filled with solid interior packing and with a movable disk, which entirely precludes all access to the interior of the lock. Hence

these locks cannot be affected by any explosive, except such as would blow the entire structure to pieces, and bury the experimenter among the ruins. These locks differ from all others in having a series of holding points, all of which must be destroyed before the safe can be broken into, instead of one point only, as is usually the case. As no strong room, safe, or lock can be regarded as continuously secure, unless the possessor of the key has the means, independently of its manufacturers, of making such alterations in it as will

drilling without previously softening the plates and maintaining them in a softened condition. Steel and iron in such a combination cannot be easily broken in pieces, as would be the case with slabs of steel only. The various means that have hitherto been adopted against such violence in this and other countries have been slabs of cast iron, interlaced with a network of iron bars to strengthen the cast metal, first patented by Newton in 1833, by Lilly in 1856, and improved on by the introduction of spiegleisen by Herring in

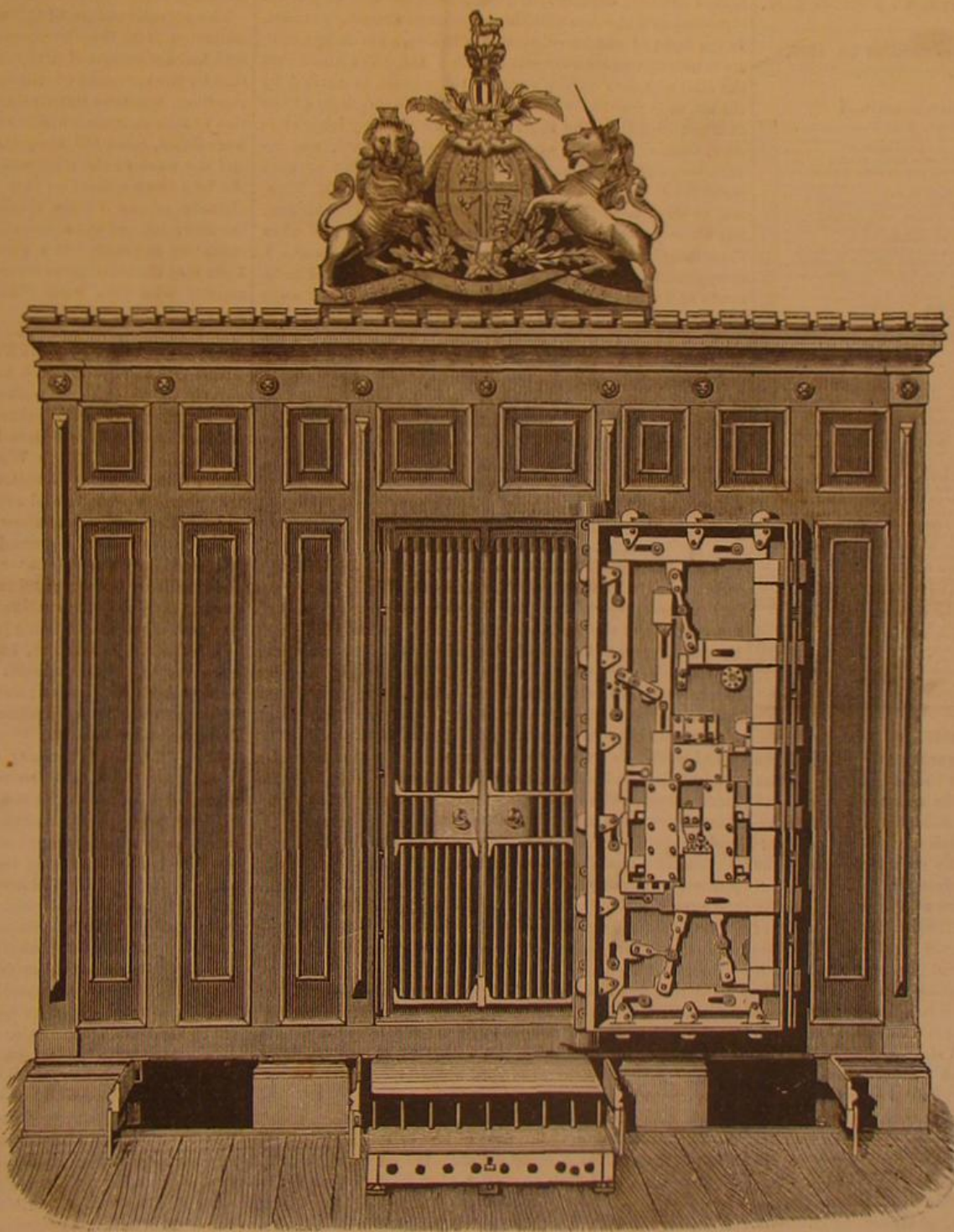
1864. The plan of security adopted in the strong room of Messrs. Hobbs, Hart & Co., first employed by them in 1857, unquestionably surpasses all hitherto devised means of defence against skilled violence. The sixty-two sections of the room are connected by outside and inside angle iron 5 x 5 x ½ of an inch thick, and 6 x 6 x 1 inch thick; while that forming the door is made of angle iron 9 x 6 x 1 inch thick, attached to the plates by means of rivets and screws of the thickness of the iron, varying from 1½ inches to 3 inches apart. Beyond the outer body there is an inner chamber 1½ inches between it and the fireproofing, the object of which is to cut off the heat-transmitting power of the metals. By a system peculiar to the firm, the various materials forming the fireproofing are kept separate, thereby preventing any chemical action, either on the metal or on each other, while the outer body plates are arranged vertically, the burglar-resisting appliances are placed horizontally, and the fire-resisting chambers in opposite directions; thus all the joints are overlapped and crosswebbed. In this room a series of safes of great strength will be placed, thus providing against any possible attacks of skilled burglars or dishonest workmen. Viewing the strong room as a whole, it is a marvel of ingenuity and mechanical skill. The weight is nearly 35 tons, and the price \$12,500, delivered on board ship.

Power of Gunpowder.

M. De Saint Robert, in an article from his pen in *La Revue Scientifique*, gives the following calculation of the efficiency of a rifled cannon, the diameter of the bore of which is 3 inches, the shell of which weighs about 83 lbs., and the firing charge of which is 1½ lbs. It may thus be estimated: Experiment has shown that the velocity of the shell when it leaves the mouth

of the cannon is about 1,300 feet per second. The height from which the projectile would have to fall to acquire this velocity is 26,800 feet. Consequently the work actually done by the powder is equal to 219,000 foot pounds. On the other hand, Bunson and Schischkoff have found by direct experiment that the heat evolved by the combustion of 2.2 lbs. of gunpowder is equal to 619.5 calories. Hence the heat evolved by the above charge of 1½ lbs. of powder is equal to 340.7 calories. The mechanical work corresponding to this amount of heat is 1,050,000 foot pounds. Comparing this, which is the possible mechanical work, with the actual work done on the projectile as given above, the ratio is 0.208 for the effectiveness of the cannon, that is to say, about 21 per cent.

THE INDUCED CURRENT.—"It appeared as if the current, on its first rush through the primary wire, sought a purchase in the secondary one, and, by a kind of kick, impelled backward through the latter an electric wave, which subsided as soon as the primary current was fully established."—Tyndall.



BANKER'S STRONG ROOM.

virtually make an entirely new combination of the lock, the firm have invented a lock and key which render the possessor independent of any workman, as he can at any moment change the combination of this key on every change of servants, or on any suspicion that a duplicate key has been made, from the original or from a wax impression.

The door as well as the body of the room is formed of iron and steel welded together. The weight of the door alone is nearly two tons. By means of equivalents for hinges—namely, 2½ inches pin centers—the working of the door, notwithstanding its weight, is perfectly under control. It is held to the room by a series of clutch bolts, passing through interlacing projections into corresponding recesses in the frame, maintained in position by wedge bolts, thus rendering it mechanically impossible to wrench the door by means of levers, wedges, or screw jacks. The exterior plates forming the body of the room are made of ½ of an inch wrought iron Staffordshire plates, attached to which are defences of high and low carbonized welded steel and iron, to prevent

Scientific American.

MUNN & CO., Editors and Proprietors.
PUBLISHED WEEKLY AT
NO. 37 PARK ROW, NEW YORK.

O. D. MUNN.

A. E. BEACH.

TERMS.

One copy, one year, postage included.....\$3 00
One copy, six months, postage included..... 1 00

Club Rates.

Ten copies, one year, each \$2 70, postage included.....\$27 00
Over ten copies, same rate each, postage included..... 2 70

By the new law, postage is payable in advance by the publishers, and the subscriber then receives the paper free of charge.

NOTE.—Persons subscribing will please to give their full names, and Post Office and State address, plainly written, and also state at which time they wish their subscriptions to commence, otherwise the paper will be sent from the receipt of the order. When requested, the numbers can be supplied from January 1st, when the volume commenced. In case of changing residence, state former address, as well as give the new one. No changes can be made unless the former address is given.

VOLUME XXXIII, No. 31. [NEW SERIES.] Thirtieth Year.

NEW YORK, SATURDAY, NOVEMBER 20, 1875.

Contents.

(Illustrated articles are marked with an asterisk.)

Adhesion, surface.....	320	Inventions, useful.....	325
Air, a draft of.....	320	Liquor, love of, cure for.....	329
Air, how it is spilled.....	320	Locomotive smoke stacks (4).....	331
American inventions in Europe.....	321	Lubricator for sewing machines.....	332
Answers to correspondents.....	331	Lucern.....	331
Arsenic in the air of rooms.....	331	Metal, fusible (10).....	331
Automaton, man as an.....	331	Microscopic bi-centennial, a.....	331
Bleaching fluid, instantaneous.....	331	Mountain gaps, how formed.....	330
Boilers, clay for coating (1).....	331	New books and publications.....	330
Boilers, pressure in (11).....	331	Optical experiment.....	329
Boilers, setting (5).....	331	Paper on drawing boards, to fix.....	331
Boilers, water in (5).....	331	Patents, American and foreign.....	330
Broom-sewing machine.....	332	Patents, the industries.....	332
Burstones, to fill holes in.....	332	Patents, list of Canadian.....	332
Business and personal.....	332	Patents, official list of.....	332
Callipers.....	332	Patent, the Woodbury.....	332
Calorimeter.....	332	Planer war, the Woodbury.....	332
Candle-wick gas.....	332	Plaster for hard finish (12).....	331
Can-soldering machine.....	332	Poisoning by wall paper.....	332
Carbonic acid tanks.....	332	Polarizer, a collodion.....	332
Car replacers.....	332	Prism, liquid, substitute for.....	332
Car starters.....	332	Propeller, a new.....	332
Center gage.....	332	Rails, long.....	332
Centers for arches.....	332	Reclips, useful.....	332
Clouds, the velocity of.....	332	Refrigerator steamer, proposed.....	332
Colors, new vehicle for.....	332	Riding, fast horseback.....	331
Current, the induced.....	332	Sailing faster than the wind (21).....	331
Dyed goods, improving.....	332	School room deformities.....	332
Electric machine, new.....	332	School room, size of.....	332
Elevator, duplex water.....	332	Scouring liquid.....	332
Engines for boats (6).....	332	Sewing machines in Scotland.....	332
Engines, power of (5).....	332	Signal, the highest.....	332
Engines, rotary, etc. (3).....	332	Silver bath from ditch water.....	332
Expansion and contraction.....	332	Silver cleaning (14).....	331
Fans, blast of (12).....	332	Sleeping rooms, small.....	332
File, a new patent.....	332	Solder for silver (14).....	331
Flour, Graham, counterfeited.....	332	Solvents, powerful (15).....	331
Freezing mixtures.....	332	Sore throat, treatment of.....	332
Gases, the vapors of liquids.....	332	Southern States exposition, the.....	332
Gas explosion.....	332	Spark spectra apparatus.....	332
Gold, new reagent for.....	332	Square, laying of a.....	332
Gorilla, a captive.....	332	Strong room for valuables.....	332
Gunpowder, power of.....	332	Telegraph system, new.....	332
Heat and light, production of.....	332	Varnish, waterproof (15).....	331
Heat, special.....	332	Vineyard, the Garston.....	331
Hygiene, blast of.....	332	War engines, ancient.....	332
Ice boats and the wind (21).....	332	War kite, the.....	332
Ink, obliterating.....	332	Water closet, odorless.....	332
Inventions patented in England.....	330	Water, temperature of (7).....	331
		Yucca stricta, the.....	331

SURFACE ADHESION.

The adhesion of surfaces is of much greater importance and of more general application, in the economy of Nature and in the production of a multitude of phenomena, than appears at first sight. It produces not only the friction between solids in contact (without which it would be very difficult, if not impossible, to attain any stability) but also the retention of liquids against the surface of solids, without which we would be unable to moisten or lubricate effectively any solid surface. This surface adhesion between a liquid and a solid of course increases with the increase of the surface of the solid, and the most direct illustration of this is the fact that, while, for instance, solid stones sink rapidly in water, when crushed they sink much more slowly, and this exactly in proportion as they are more finely divided; thus, while the stones in a river will sink even when the current is swift, the coarse sand will be carried along, and not sink unless the current is slow; while the very finest sand, notwithstanding it consists of the very same material as the stones, will not be deposited at all except where the water is at perfect rest. Hence the coarseness or fineness of the gravel in a river bottom depends on the speed of the current. The most striking illustration of this property is found in the process of elutriation, practised by chemists. It consists in grinding insoluble products with a little water to a thin paste, and then suddenly diffusing the paste through a large quantity of water in a deep vessel, from which, after the subsidence of the coarser portion, which at once takes place, the supernatant liquid is poured into another vessel and allowed to deposit the next fine parts held in suspension. After a time, say 15 or 20 minutes, it is again decanted, and the apparently clear water left to settle for several days, when a small quantity of the very finest impalpable powder is obtained. In the preparation of emery and other polishing powders of numerous grades of fineness, several vessels are employed; and the muddy liquid, first left to settle a short time, is poured in the second, left to settle a little longer, then poured in the third, and so on. The powder of this hard substance, last deposited, is in so minute a state of division as to possess very great value as a polishing agent.

Adhesion also exists between gases and the surfaces of liquids or solids, and is the origin of many phenomena, the sole cause of which must be looked for in this adhesion. If, for instance, there were no adhesion between the air and the surface of water, there would be no friction between them; and the wind would move freely over the surface of

the ocean, and would be unable to raise waves. The proof of this is that, if we cover the surface of water with a film of a lighter liquid, like oil, having less adhesion to air, thus having friction less than that of water with air, the winds will glide over it without raising waves; hence the well known quieting influence of oil on the surface of water agitated by the boisterous winds; and use of this property has occasionally been made with good effect when oil was on hand. It is the same adhesion of air to solids which causes the dust to be raised by wind, notwithstanding that the particles of dust are much heavier than the air.

But the most important example of this force of surface adhesion is the power of the air to hold up fine particles of water in the form of clouds. To explain this apparently wonderful support of water in the atmosphere, so great a man as De Saussure had recourse to the absurd hypothesis that the water particles of which clouds and fogs consist were small hollow, vesicular spheres, like microscopic soap bubbles, with a vacuum inside, and therefore specifically lighter than the air. And microscopists even went so far as to investigate the vapor of hot water, to see if the ascending globular particles were hollow inside. Some of them even asserted that they found this to be so; but every one experienced in microscopic observations knows that it is next to impossible to decide if a very transparent globular object is hollow or solid, especially if it moves in the field of the instrument, as is the case with the particles of ascending vapors. In the light of our knowledge of adhesion, such an hypothesis is utterly unnecessary and uncalled for. We know that the dust of heavy solids, even of the metals, is carried by the air, as is proved by the microscopic observations of the dust collected from the roofs of the houses in any large city; why, then, cannot dust of water be carried upward, and remain suspended? If any one doubts the existence of such water dust, let him observe the spray of the Falls of Niagara, or other large falls, and see how it ascends. It is nothing but water ground to dust by the tremendous fall; and when the atmosphere is not dry enough to absorb it and make it disappear, it will rise to elevations of hundreds and thousands of feet, and form real clouds, which will float away with the others. The size of these particles determines the height to which they will ascend; the finer will form the upper clouds, the coarser the low, floating fogs. Dr. Angus Smith recently recorded a fog which he observed in Iceland, of which the particles were larger than he ever saw before. It rolled low over the ground like a dust, and microscopic observation convinced him that the particles were not hollow but solid, and he found the diameter to be $\frac{1}{100}$ part of an inch. He also refers in his account to the absurdity of the vacuum hollow sphere theory, which only shows that the greatest inventor is liable to invent erroneous theories.

HOW SOME MOUNTAIN GAPS HAVE BEEN FORMED.

Every one who has visited the Delaware Water Gap, or ascended the Susquehanna from Harrisburg, or passed through the cut where the Potomac has pierced the Blue Ridge at Harper's Ferry, or has seen indeed any one of the numerous gaps made by seaward-flowing rivers through the long mountain ridges which flank the Alleghenies, must have been struck by the question how a comparatively small stream could overcome so formidable an obstruction.

Evidently the river could not have taken advantage of a natural cleft or fissure through the mountain dam, for the strata correspond on the opposing sides of the gap, and the river flows over an unbroken stratum under-running the broken strata of the banks. The gap as plainly denotes a section cut out of the mountain as a notch in a stick does the removal of the wood. The disconnected edges of the strata tell precisely the same story as the severed lines of annual growth on the sides of a wood chopper's cut: the connecting portions of wood and stone have been removed. The question is: How?

The first and most natural supposition would be that the valley, back of the dam, had originally been filled, forming a lake whose outlet was over the ridge above the present river channel; and that, as the outlet was lowered by the wearing down of the obstruction, the lake was drained until the entire valley was laid bare.

This supposition is negated by the plain fact that it would be impossible to fill the valley to the height of the ridge at the point of the gap. Before the water could reach that level it would find an outlet elsewhere, where the natural elevation of the dam was less. An excellent illustration occurs a few miles above Harrisburg, where the Susquehanna crosses a flexure of the mountain ridge, cutting twice through the mountains within a few miles, when apparently it might easily have avoided the obstruction by going a few miles around.

Another supposition is that originally the river ran at a level corresponding with the top of the ridge, and that the present valley through which it runs is the result of erosion; while the river was slowly wearing through the hard mountain strata, the softer earth of the surrounding country was washed away through its sinking channel, leaving the more unyielding rocks in mountain ridges. From this point of view, the river is to be regarded not merely as the cleaver of the mountain barrier but as the creator of it, by reducing the level of the adjacent land.

Hitherto this supposition has been the most plausible and the most generally accepted. But another and perhaps truer explanation is suggested in Professor Powell's "Exploration of the Canons of the Colorado."

As our Atlantic rivers cut through the Allegheny ridges, so the Green River, the chief head stream of the Colorado, pierces the Uinta Mountains, flowing through a series of canyons compared with which our eastern water gaps are in

significant. As in the case of the Susquehanna, above noted, the river bursts through the opposing mountains when apparently it might have found an easier passage by going round them. Why did it choose the harder course?

Professor Powell's answer is that it had the right of way. It was running there before the mountains were formed and simply removed the obstruction as fast as it rose in the way.

The contraction of the earth causes the strata near the surface to wrinkle or fold, and such a fold was started at Harper's Ferry, the course of the stream now known as Green River. "Had the fold been suddenly formed, it would have been an obstruction sufficient to turn the water into a new course, to the east, beyond the extension of the wrinkle; but the emergence of the fold above the general surface of the country was little if any faster than the progress of the corrosion of the channel. We may say, then, that the river did not cut its way down through the mountains, from a height of many thousand feet above its present site; but having an elevation, differing but little perhaps from what it now has, as the fold was lifted, it cleared away the obstruction by cutting a cañon, and the walls were thus elevated on either side. The river preserved its level, but the mountains were lifted up, as the saw revolves on a fixed point as the log through which it cuts is moved along. The river was the saw which cut the mountains in two."

The gigantic nature of this aqueous saw cut can be faintly estimated from the circumstance that the mountain log or fold had a diameter of fifty miles, while the depth of the cut, that is, the elevation of the fold above the present level of the river, was over twenty-four thousand feet. But a fraction of this enormous uplift of rock remains. As the rocks were lifted, rains fell upon them and gathered into streams, and the wash of the rains and the corrosion of the rivers cut the fold down almost as fast as it rose, so that the present altitude of the Uintas marks only the difference between the elevation and the denudation. The mountains were not thrust up as peaks, but a great block was slowly lifted, and from this the mountains were carved by the clouds—patient artists, who take what time may be necessary for their work."

THE WOODBURY PLANER WAR.

The manufacturers and users of the woodworking machinery on which the Woodbury Planer Patent Company are endeavoring to collect royalties, on the ground of an alleged infringement, will doubtless learn with gratification that at length the claims of the Woodbury people have been fairly brought before a United States Court. It will be remembered that a motion was granted some time ago in Washington, requiring the claimants to show cause why their patent should not be set aside on the ground of fraud. The time to appear was fixed for June 23, but an extension was granted until the middle of October; and from that period, it appears, still further time has been obtained, so that there is no immediate prospect of the matter being judicially determined from these proceedings. A suit has, however, been commenced by the Woodbury Company against Messrs. Stearns & Sons, large lumber dealers in Boston; and as this firm is resolute in refusing any compromise whatever, the cause at issue will in due process be reached.

Meanwhile the Woodbury Company seem to be resorting to all kinds of efforts to secure their tax. They have compromised with several users by giving licenses of a face value of \$100 for \$20 per machine; and one of their agents (or rather an individual named Allen, who claims to be such, and who has been endeavoring to frighten royalties out of small manufacturers in Massachusetts by representing himself as a United States Marshal, and acting otherwise fraudulently) has been locked up on criminal charges.

From 1,000 to 1,200 manufacturers and users of machines are now allied against the Woodbury monopoly, and the intention is to devote all possible energy to the breaking down of the claims of the latter by vigorously contesting the matter in the United States Court. The whole affair from beginning to end needs the searching scrutiny of a judicial examination. It began with Woodbury attempting to get a patent for a device which the courts had long previously decided to be an infringement on a prior patented invention. The Patent Office rejected his application in 1853, and thereupon woodworking people throughout the country adopted the pressure bar (intrinsically a most useful attachment) and used it, undisturbed, for eighteen years. In July, 1870, an act of Congress was passed, containing the following clause: "That when an application for a patent has been rejected or withdrawn prior to the passage of this act, the applicant shall have six months from the date of such passage to renew his application or to file a new one; and if he omit to do either, his application shall be held to have been abandoned."

As a necessary consequence hundreds of old cases were revamped, including Woodbury's; but his application was again rejected. In January, 1873, another application met another rejection, and then, on April 26 of the same year, the Patent Office turned a complete somersault and declared all its previous decisions to be untenable and a tissue of blunders, and allowed the patent. The Commissioner, although the case was not in legitimate course before him, previously ordered that it be decided on its merits, without reference to abandonment, and gave instructions that no interference should be declared under the rule; and thereupon the patent was issued three days after its allowance, and two weeks ahead of the usual time.

When the act of Congress, containing the above quoted clause, was passed, we questioned its wisdom, and expressed the belief that it was framed more with a view to benefit some special case than to meet public exigencies. Certainly the facts relating to this Woodbury job point to the affirm-

tion of that belief. The unusual action of the Commissioner we also stated at the time to be well calculated to create a suspicion of partiality, and not at all likely to impress inventors with the idea that the Patent Office was perfectly fair in its dealings. Mr. Leggett, however, in a recent letter to the *Northwestern Lumberman*, gives explanation of his course in the matter, and states that he felt bound to order the grant of the patent from the fact that the courts had decided that the public use of an invention, between the time of first application and that of the grant of a patent, if without the consent or allowance of the applicant, could not be construed as a public use in such sense as to prevent the grant of a patent. Regarding the merits of the present controversy, and especially in relation to the validity of the patent, the ex-Commissioner unreservedly speaks his mind as follows:

"I knew that the doctrine as laid down by the Court would grant the patent; yet I just as well knew that the patent ought not to be granted, and I believed that it would not be valid if granted. I have never believed from that time to this that the patent could stand a thorough litigation. I believe, if properly placed before any court of competent jurisdiction, they will declare it to be invalid. I so expressed myself upon it openly and frequently before the patent issued, upon its issue, and on every occasion I have had to do so ever since. I believe the whole thing to be a fraud upon the public."

To review the long array of arguments bearing upon the validity of the patent would require more space than is at our present command. It is enough to hope that everything relating to the case will be thoroughly ventilated during the approaching trial. If a broad flood of light can be shed into the inner history of the circumstances attending the passage of the act of Congress, and of the descents made by the Woodbury people upon the manufacturers who, for a score and over of years, have undisturbedly used the pressure bar, we have little doubt but that the public will be treated to a most interesting record of jobbing and rapacity.

EXPANSION AND CONTRACTION BY MOISTURE.

The effect of water or moisture on certain porous materials varies, under slightly different circumstances, so as to be apparently inconsistent. The general effect is to cause an increase in size, as the water is absorbed in the pores by capillarity, which causes them to enlarge, the watery atoms acting as so many wedges, forcibly driven in, causing a general expansion of the body; a sponge is the type of this kind of expansion, as its structure being similar in all directions, the effects are also alike all round.

A piece of wood presents other conditions. The fibers are directly connected, and this connection is longitudinal, while the pores are between the fibers transversely. When, therefore, the pores absorb water, its particles do not enter between the longitudinal connections, but between the transverse ones, and the result is a transverse expansion or swelling, while the length will not perceptibly increase. This swelling by moisture and the subsequent shrinkage by drying are always in a transverse direction, and are familiar and well understood.

Paper, whether made from wood or any other fiber, will, by the influence of moisture, expand in all its dimensions, if the fibers lay in all directions. Such is the case with the hand-made paper, once in universal use, but now only known in the form of some drawing and writing papers; but in the machine-made paper, especially if made from long fibers, such as those of jute, the fibers lay more or less in the direction in which the paper moved on the machine by which it was made. This fact is easily ascertained by trying to tear it, as it will tear much more easily longitudinally with the fibers than transversely across them. Such paper will expand by moisture less longitudinally than transversely; and if a paper hygrometer be made, for estimating the amount of atmospheric moisture by the elongation of a strip, the little instrument will be much more sensitive if the strip be cut transversely to the direction of the fibers than if it is cut longitudinally, or parallel to this direction. These conditions are still more obvious with wood, and hygrometers have been made of long strips of very porous wood, glued together end to end, but all cut transversely to the board. Very sensitive instruments have been constructed in this way. A long human hair has been used for the same purpose. It elongates by moisture; and when one end is fixed, and the other end wound around the axis of a hand moving over a dial, the slight elongation may be magnified, and a tolerably reliable instrument obtained, the credit of the invention of which belongs to De Saussure. If a hemp or flax rope, in which the fibers are not twisted, but lay all parallel and longitudinally, could be made, it would increase by moisture in thickness, and not at all or very little in length. All ropes, however, are held together by twisting the fibers, giving the whole the form of a long screw; and then the effect of expansion in thickness by moisture influences in a peculiar way the length, it thickens the strands, and, although it has the effect of tightening the twists, as if the rope were more tightly twisted, it shortens the length; and the shortening by moisture or water varies directly with the degree to which the rope was twisted in making. This effect is very perceptible in clothes lines, which will become quite taut when wet, so much so, indeed, as often to extract the hooks to which they are attached, or pull the poles out of plumb. One of the most striking instances of this kind which we ever witnessed was with a bell rope in a light-house on the coast of France, nearly 300 feet high, with a first class revolving Fresnel light on top. The attendants were signaled by means of a bell at the top, pulled by a twisted hempen cord suspended inside the tower; and this cord became a perfect hygrometer. On dry days it hung down to about three or four feet from the ground; while on moist days the end was six feet from the earth, and on very

wet days even more, so that it had to be elongated in order to be always within reach.

The practical applications of these properties are, besides the use of hygroscopic substances for hygrometers, the insertion of dry wooden wedges in grooves made in stone in quarries, by wetting which they swell and detach the stones; this is largely employed in the millstone quarries in France. The swelling, untwisting, and shortening of ropes by water is often made use of to produce a strong traction for a short distance. As a most remarkable example of this kind, it is recorded that, in the reign of Pope Sixtus the Fifth, a colossal obelisk, which had been brought from Egypt, was being erected in Rome; it was ordered that, during the difficult and critical operation of raising it, a profound silence should be observed by the spectators, so as not to interfere with the commands of Zapaglia, the engineer and architect, who had made all the calculations for the machinery required, so as to secure the success of the enterprise. When the obelisk was raised, however, he found that he had not sufficiently taken into consideration the stretching of the ropes by the enormous weight; he saw that the obelisk was lifted about half an inch less than the height of the pedestal on which it had to stand. Fortunately, at this critical moment, he remembered the effect of water on ropes, and his voice was heard, in the universal silence, ordering the ropes to be wetted. This was at once done, and in a minute the obelisk was raised, by the contraction of the ropes, to the right height, and successfully placed on the pedestal.

MAN AS AN AUTOMATON.

A little more than a year ago Professor Huxley startled the world with his famous paper on "Animals as Automata." In that paper, this lucid writer and bold thinker used the word automaton in much the same sense as we use the adjective automatic, namely, to describe something which acts involuntarily, and not, as Webster defines it, "a self-moving machine, or one which has its driving power within itself." Professor Huxley meant to say that the movements of animals were directly caused by external impressions, independently of any exercise of will power; in other words, they were machines, upon which certain causes produced certain effects. We are not yet ready to acknowledge ourselves as automata or machines (and really the two words mean the same thing), even if so great a philosopher as Huxley should tell us we were.

The differences between a man and a machine are numerous. In the variety of work performed, man surpasses any engine that he has yet devised, although many of his machines surpass in perfection their builder. Where great accuracy, great delicacy, or great strength are requisite, the machine outstrips the man; and yet so simple a motion as that of walking has been but poorly imitated by machinery.

The superiority of a man to a machine is shown by his ability to devise and construct machines; it is, in fact, the superiority of mind to matter. But between the machine which can do nothing but what it was expressly built for and the intelligent thinker and inventor who planned the machine, there are all the intermediate stages represented by different members of the human family. There are men of little brains and much muscle, men of big brains and less muscle; men who plod along, year after year, in the paths which their fathers trod, and men who put all their heavy work on muscles of steel and of leather. The proportion of wide-awake, thinking men to dull routine plodders in different countries or sections of country is easily determined by the relative number of patents taken out in that country; and measured by this standard, the United States contains the least proportion of automata.

But there is a word to be said in favor of automata or man machines. Even now, toward the close of this nineteenth century, there remain many kinds of labor which cannot be done by machinery. There is also a large number of men, and women too (for the fair sex are not to be excluded in this classification), required to tend the machines, feed them, prepare work for them, and fill up the gaps in their work. For some of these positions there are required skill, thoughtful care, presence of mind, nerve, and ingenuity. Yet the more nearly all our motions resemble those of a machine, the greater is the amount of work we can do in a given time, and the less the fatigue. As the movements become automatic and regular, removed apparently from the control of the will, they become more rapid and easier. Why has division of labor accomplished so much? Chiefly because a man whose sole work it is to do one particular thing not only comes to do it better, but learns to do it with the least expenditure of time and the least exertion of brain and muscle; in fact he works very much like a machine. The compositor's hand travels the same road every time as it goes from the case to the stick; the bricklayer always seizes his brick with the same hand, and makes no unnecessary motions in conveying it to its place, in preparing its mortar-lined couch, or tapping it home; the shoemaker whose sole labor is nailing on heels goes through the few simple motions automatically, no more stopping to think which tool is next required or where he is to look for his nails than an old woman when knitting thinks about the stitch, or an ordinary person thinks what muscles he is to call into play when he is walking. Does a rapid penman ever stop to recal the shape of a letter, or do his words and thoughts flow automatically from his finger ends? The fingers of an experienced player find the keys of his piano as a compositor finds his type boxes, or the hand knitter her needles and yarn, automatically.

Habit is another term often employed to designate what we do automatically, but habit applies alike to mind and

muscle. A man accustomed to smoke or drink does not do these things without thinking about them; habit only causes and strengthens the desire. On the other hand a man who habitually swears, like a woman who bites her finger nails, does it unconsciously, and hence automatically. It is acknowledged to be a good thing to possess good habits, and not merely be free from bad ones; so it is equally desirable for a man employed in any specialty to acquire the simplest and best way of doing his work; this way selected, let him adhere to it perseveringly until it becomes automatic. Let the habit become fixed, and he will find his speed increase and the exertion diminish. To accomplish this desirable end, it is, however, absolutely necessary that no superfluous movement be made. In feeding a small hand printing press, where each card must be laid on separately. If the cards be piled in such a manner as to involve turning each one over or around, the speed is reduced at least 10 per cent. Every motion, however slight, which must be repeated 50 to 100 times per minute is time-robbing. The writer who crosses his t's and dots his i's cannot write so fast as he who does not. The man who spells bought, through, received, etc., in their simpler forms bo't, thro', and rec'd, saves a large percentage of time; and if all the silent and useless letters were omitted, the most hasty scribblers could find time to write distinctly. As that system of shorthand which has the fewest strokes consistent with legibility receives the preference, so that language which uses the fewest and shortest words to express an idea perspicuously deserves to become the universal language of the commercial world.

"Practice makes perfect" is a good old proverb and a true one; but what is the use of perfection in bad methods? The man who always carried a stone in one end of the bag to balance his girth may have arrived at perfection in the selection of a suitable stone; but what gain was that? First use your brains in devising the shortest and quickest methods, then by practice learn to do them automatically, and you have a maximum of speed with a minimum of labor.

AMERICAN INVENTIONS RE-DISCOVERED IN EUROPE.

It is no unfrequent thing for us to meet, in the columns of European papers, notices published with all the flourish peculiar to the first announcements of strikingly novel ideas, concerning old American inventions, long known and used here. Here are two examples in point: "A French blacksmith has devised a perforated plate, put in rotation by clock-work, and intended to be placed behind the lock of a safe. The consequence is that the safe cannot be opened except at certain times during business hours, when there is no danger of any robber intruding into the offices." This is from a late number of *Nature*, one of the keenest of English scientific weeklies. A chronometer lock was patented in this country by John Y. Savage in 1847, and has for years been in use here upon safes in banks, government treasuries, and business houses. The French blacksmith and *Nature's* item are twenty-eight years behind the age.

The second paragraph begins as follows: "Of all the extraordinary discoveries which have been announced of late, Germany sends us the most surprising." After which, the *English Textile Manufacturer* proceeds to describe wool made from liquid furnace slag by blowing through it a steam or air jet. This is not a German discovery. It was invented by Mr. John Player, deceased, and patented here by Amelia Player, of Philadelphia, Pa., his administratrix, May 31, 1870. Descriptions of beautiful examples of this curious product have heretofore been published in our paper.

SCIENTIFIC AND PRACTICAL INFORMATION.

TO FIX PAPER ON DRAWING BOARDS.

Take a sheet of drawing paper and damp it on the back side with a wet sponge and clean water. While the paper is expanding, take a spoonful of wheat flour, mix with a little cold water, and make it a moderately thick paste; spread the paste round the edge of the drawing paper one inch wide with a feather, then turn the drawing paper over and press the edges down on the board. After this take four straight pieces of deal wood, $\frac{1}{4}$ inch by 2 $\frac{1}{2}$ inches wide; place them on the edge of the drawing paper, and put a large book or heavy weight on each corner to make the paper adhere firmly to the board. In about an hour's time the paper will be straight and even, and quite ready for executing a drawing. When the drawing is finished, take a sharp knife and raise one corner of the paper, then take a scale, run it round the edges, and the paper will come off easily. Turn it over and take the dry paste off with a knife, and all will be perfectly clean, and no paper will be wasted.

A MICROSCOPIC BI-CENTENNIAL.

The city of Delft, Holland, has recently celebrated the bi-centennial anniversary of the discovery of microscopic infusoria by Antony Van Leeuwenhoek. Public memorial services were held, a monument unveiled, a banquet partaken of, and the discoverer's instruments displayed. It is something new to witness people of all classes in a city taking part in an enthusiastic celebration of a discovery made two hundred years ago, and regarding which the average individual knows so little.

FAST HORSEBACK RIDING.—At a fair at Waco, Texas, lately, a horseman rode for a wager sixty miles in two hours and fifty-five minutes, using relays of ordinary Texas horses to the number of forty-two. His last mile was made in two minutes and seven seconds, and his time for the sixty miles was five minutes better than the best time ever recorded in this method of racing.

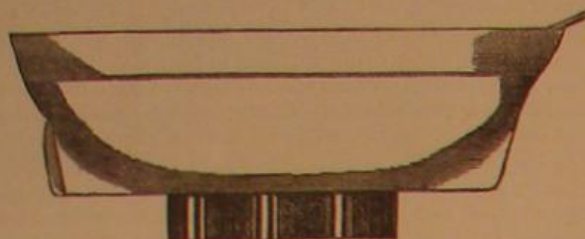
FARADAY established the fact that gases are but the vapors of liquids possessing a very low boiling point.

A NEW PROPELLER.

The peculiar mechanism of the dorsal fin of the pipe fish (*syngnathus*) and sea horse (*hippocampus*), which is also known to be present in the electric eel (*gymnotus*), has been referred to by more than one naturalist. The action is a kind of wave, commencing at the front end and continued through its whole length, continually repeated, so as to form a kind of screw propeller.

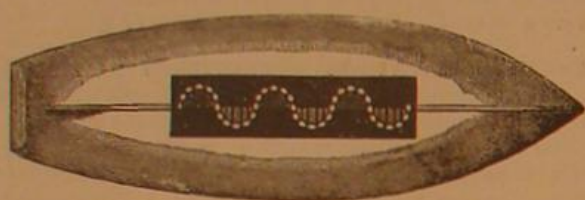
It is not difficult to imitate artificially this undulatory fin of the abovementioned fish. A series of rods hinged near their middle on a single axis will evidently represent at one end any movements given to them at the other. Therefore,

Fig. 1.



If they are made to come in contact at one extremity with the side of a screw which is placed perpendicularly to their direction, and at the same time is provided with projecting disks at right angles to its axis, one between every two rods, to keep them in place, the opposite tips will form an undulating curve, just in the same way that the ivory balls, in the eccentric apparatus so frequently employed by lecturers on experimental physics, are made to represent the undulations of the atoms of the luminiferous ether in the production of

Fig. 2.



light. Like this apparatus, also, if the screw be made to rotate, an undulation will travel along the rods, which is exactly similar to that observed in the fin of the sea horse. Such a piece of machinery, driven by clockwork, ought, theoretically, to propel a boat if properly placed. Mr. C. Becker, says *Nature*, of the firm of Messrs. Elliott & Co., has constructed such a boat, (seen sideways in Fig. 1, and from below in Fig. 2). Its speed is slow, as is that of the fish; in the former case this is accounted for by the fact that the machinery is, in this particular instance, perhaps a little too heavy, at the same time that the friction developed in its action is very considerable. In the artificial fin there are just three complete undulations with eight rods in each semi-undulation, forty-eight in all. Between the rods the membranous portion of the fish's fin is represented by oiled silk. The rods and the other portions of the driving gear are so arranged that the former project, with their undulating ends and the oiled silk, in the middle of the boat, along the line of the keel. They form what may be termed a median ventral fin. The undulations are very complete, the curves being true semicircles.

LUBRICATING DEVICE FOR SEWING AND OTHER LIGHT MACHINES.

The article in ordinary use for applying oil to machinery is the pressure or spurt oil can. For the machine shop, where dirt and oil seem to be matters of no moment, this apparatus serves an excellent purpose; but for sewing machines, and light machinery in general, the use of it is open to many objections



Besides the trouble of pouring oil from a bottle into the can, the delivery of oil from the spurt cans is very uncertain. You put the point of the tube against the part of the machinery requiring oil, and give a gentle pressure with your thumb on the bottom, and nothing comes. You press again a little harder, with the same result. Then, if you are only an average specimen of humanity, you get provoked and give a squeeze which nearly collapses the cup, and a

small deluge of oil flows out and over not only the bearing, but it gently trickles down on the work or one's clothes, and it takes a woman with an angelic temper not to say something a trifle hasty. Then, when you put your oil can down, the surplus oil flows down the outside of the tube over the cup, and slowly meanders around the table, ready to soil the next thing it comes in contact with; and you can set it down as a rule that, when one introduces a spurt oil can into the house, he ought also to bring a gallon of benzine with which to antidote it.

With the little device illustrated herewith, it is claimed that all this is avoided. The cork, or stopper, and rod are made to fit the oil bottle, just as it is received from the dealer, and it is always ready for use. To operate it, remove the rod by means of the little knob attached to the stopper. The latter comes out with its groove full of oil. Touch the point of the rod to the parts requiring lubrication, and the oil flows as long as necessary. Remove the point at just the right moment to leave the exact quantity needed. The rod is returned to the bottle, the cork pressed in, and the bottle is safe from spilling from a chance overturn; and the hands, work, and table are clean, and no oil is lost or wasted.

As evidence of the value of this little invention, the inventor estimates that a sewing machine company, using 100,000 oil cans, would save \$4,000 or more per annum by adopting this device. Few persons, he thinks, after trying the invention on their sewing machine, jig saw, lathe, or other light machinery, would willingly go back to the old can.

Patented September 28, 1875. For further information address the inventor, Mr. G. A. Sawyer, care Trump Brothers, Wilmington, Del.

A NEW PATENT FILE.

We illustrate in the annexed engravings a new method of

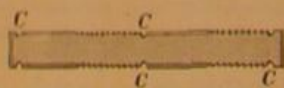
Fig. 1.



cutting files, through which, it is claimed, the tool is caused to partake of the advantages of both the single cut and the cross-cut file. The invention, which will be readily understood from the illustrations, consists in forming, on the surface of a file of the usual shape, a number of sections, A, Fig. 1, of cross-cut teeth alternated with a similar number of sections, B, of single-cut teeth. Also, at the point of intersection between each cross-cut and single-cut division, and for the purpose of meeting the requirements of coarse filing, a groove, C, is made, shown in section in Fig. 2, which is parallel with the edges of the various divisions and has a depth and width greater than those of any of the other cuts. The object of these diagonal grooves is to collect the particles of metal abraded and to prevent the same from being wedged into the teeth, in this way obviating the scratching, by these minute fragments, of the material worked upon.

The inventor submits to us several excellent testimonials from machinists and others who have practically tested the tool with satisfactory results. He informs us that it allows of the surface of either metal or wood being cut away with greater rapidity than is possible with a single-cut file, and at the same time it produces a smoother surface than the cross-cut file, in this manner, as stated in the be-

Fig. 2.



ginning, combining the advantages of both kinds of tool. It appears to be an efficient and useful invention, and to possess qualities of durability superior to those of files of the ordinary pattern.

Patented September 7, 1875, by Messrs. C. F. Carr and S. S. Wilcox. For further information relative to sale of rights, etc., address the last mentioned inventor at Lisle, Broome county, N. Y.

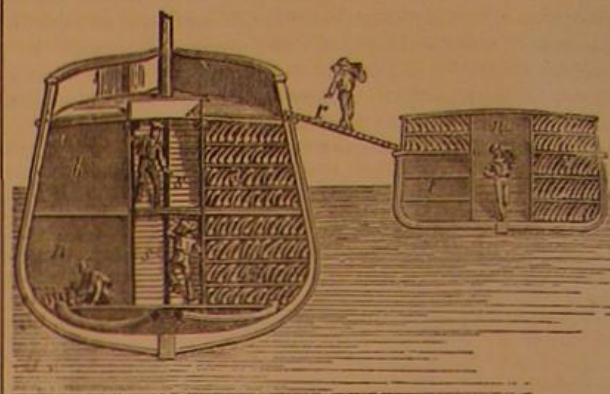
THE PROPOSED REFRIGERATOR STEAMER.

It may be safely predicted that the time is not very far distant when vessels carrying perishable cargoes, of fruit, meat, and other articles of food, will make constant and regular voyages between the tropics and the colder temperate regions. The use of refrigerator cars in transporting the fruit and vegetable productions of California to the Atlantic seaboard, and more recently the export of a quantity of American peaches to England, by steamer, during the latter part of last summer, may be considered in the light of successful experiments leading to the more important results of a steady commerce, and this more especially in view of the rapidly advancing progress in refrigerating machinery.

We lately alluded to the Tellier refrigerating apparatus, in which a low degree of temperature is transmitted to an

air blast which passes around large plates cooled by the expanded vapor of methylated spirit. By the aid of this invention, it is believed that cargoes of fruit, etc., may be carried over very long voyages even in the warmest weather, and it is now proposed practically to test this assumption. From late French journals we learn that the inventor has chartered a steamer of 900 tons, which he has named the *Frigorific*, and which he intends to load with perishable ma-

Fig. 1.



terial in France, and dispatch to La Plata, in South America. The first part of the test will consist, of course, in determining whether the outward cargo will keep over the voyage. If so, the contents of the ship will be disposed of and her hold filled with fresh beef, which will be transported to France. This transportation of beef has been the object of projectors of schemes for cooling vessels for a long time past, for the reason that, if success can be obtained, an immense

Fig. 2.



trade is at once possible. In Texas, on the pampas of South America, and in Australia, thousands of cattle are slaughtered simply for their hides, the bodies being left totally unutilized. It has of course occurred to many that to carry this enormous quantity of meat, to be bought for almost nothing, to European markets where butchers' rates are high, and especially to great cities where the poor fresh meat

Fig. 3.



is a luxury sparingly to be indulged in, would be both profitable to a high degree, and at the same time a measure of philanthropy. Hence the repeated attempts, thus far failures, which have been made to use ice as a means of preserving cargoes of dead cattle.

If, as appeared to be the case when we examined the Tellier apparatus, it is possible to maintain a temperature of 32° Fah. at so small an expense as was indicated, there is no-

thing now apparent, either in point of efficiency or in cost to prevent the success of the inventor's experiment. His mode of stowing the meat is illustrated in the annexed engravings, the object sought being of course to give a free circulation of the icy draft about every piece. For loading and unloading, it is proposed to use a scow, as shown in Fig. 1, in which the meat is packed after being taken from the ship, and so transported by canal, inland or to the wharves. The scow is fitted with a refrigerating machine and arranged somewhat similarly to the ship, as will be seen by comparing the two sections given. The mode of stowing the quarters will be understood from Figs. 2 and 3, of which Fig. 2 is a thwartship, and Fig. 3 a fore-and-aft, view of the hold. The meat is laid in regular lines upon a light framework in such a manner as to be securely held, and at the same time to take up but little room. The pipes, C and D, in Fig. 2, are respectively the inlet and outlet pipes for the cold blast.

The Frigorific, we learn, will shortly sail from France; and as the inventor has invited several members of the French Academy of Sciences to make the voyage in her, carrying with them any articles the possibilities of the preservation of which it is especially desired to test, it is probable that the experiment will be conducted under very close scientific investigation, and that a valuable report will be made.

FLASKS FOR LIQUID CARBONIC ACID.

In our article on carbonic acid gas as a motor, published recently, we neglected to state specifically that the apparatus described was the invention of Mr. W. N. Hill, chemist of the U. S. Torpedo Station, at Newport, R. I., although the fact was clear from the context. We hasten to rectify this inadvertence, and at the same time take occasion to add an engraving of the flasks referred to in our article as those in which the liquid carbonic acid is stored, after it is produced by the machinery at the rate, as we are informed, of 55 pounds per hour (continuous working).

The Highest Signal in the World.

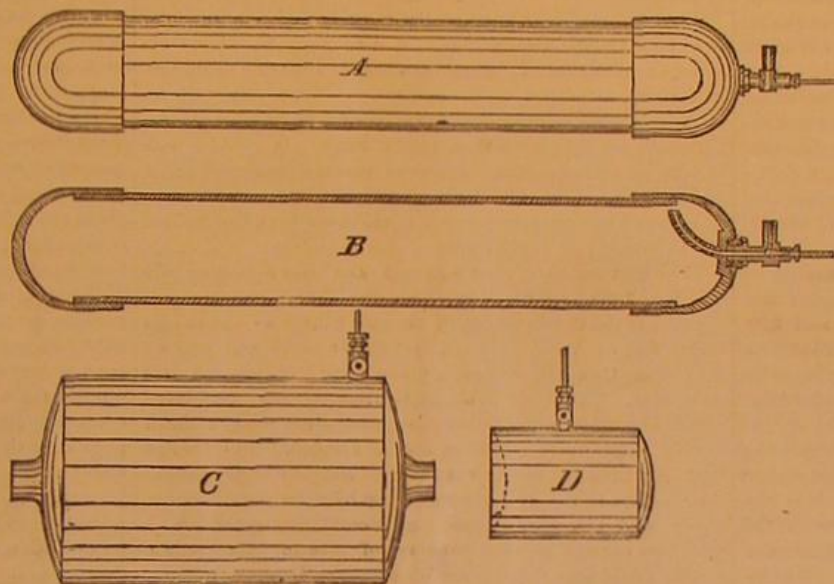
A new surveying signal has lately been erected on the summit of Mount Shasta, Cal., by the Coast Survey Department. The signal is a hollow cylinder of galvanized iron, twelve feet high and two and a half feet in diameter, surrounded by a cone of nickel plated copper, with concave sides, three feet high and three feet in diameter at the base; and its altitude is, according to the observations taken by the members of the Coast Survey, 14,402 feet. The nickel plating of the signal is a brilliant reflector, and will, from 6 to 9 A. M., and from 3 to 7 P. M., reflect the sunlight in such a manner that the reflection can be seen from the valleys and the mountains from which the summit of the mountain is visible. It is believed that it can be used for observations at a distance of one hundred miles, and possibly further.

ANCIENT WAR ENGINES.

At the time when Napoleon III. was writing his life of Julius Caesar, he caused to be constructed, at the Museum of St. Germain in Paris, a set of models of the weapons of war employed by the ancient Romans. These models (which were built, with the greatest care, according to the descriptions of Latin authors and after the representations in bas-relief on Trajan's Column), having served the purpose of the Emperor, remained objects of little interest until recently,

Two of the largest war engines are represented in the annexed engraving, for which we are indebted to *La Nature*. The onager, Fig. 1, consists of a wooden lever, A, which at its lowest end is inserted in a bundle of tightly twisted cords. These last are fixed on a massive frame, and there submitted to extreme torsion, so as to store up in them a powerful reacting force. By the aid of a windlass, the lever, A, is drawn back, thus still further twisting the cords, and the lever is secured in this position by the rope, C, passing over a hook, B. A sling, F, is suspended from the extremity of the lever, and carries the stone bullet. By means of a stop, the catch, B, is freed, when the lever flies forward with great force, bringing up against the cushion placed to receive its impact. The movement is so rapid that the eye cannot follow it, and the projectile is hurled to a distance, varying from 415 to 515 feet, according to weight. The velocity of the ball is low and its flight can easily be seen. The diameter varies from 3-1 to 5-8 inches. It is supposed that these missiles were thrown from the onager at very near range, and that they were also used to drop or roll down upon attacking parties from the summits of fortresses or palisades.

The balista, represented in Fig. 2, is a much more formidable weapon, since it is a huge crossbow mounted on a frame, which often was supported on wheels so as to be conveniently moved from place to place. For the bow is substituted two short arms, M and N, passed through bundles of twisted



FLASK FOR LIQUID CARBONIC ACID.

cords, O and P, similar to the arrangement in the onager. As the string of the balista cannot be pulled back by hand, this is done by catching it over the wooden piece, R, which last is then drawn back by the windlass. When a sufficient tension is obtained, the cord is fastened on a catch, and an arrow is placed in front of it in a suitable groove. By freeing the catch, the string flies forward, throwing out the projectile, which is of the form marked 1 and 2 in the engraving, and made of tough wood and iron. The length of the missile is 4-1 feet and weight from 2½ ozs. to 1½ lbs. The range varied, with the weight, from 690 to 480 feet.

At the upper portion of Fig. 1 are sketched the various types of defensive fortification used during the period when the above described weapons were in vogue. These consisted in walls flanked by salient towers. The Romans knew of but three varieties of fortress: the *castrum*, which included not only regular camps but any walled place; the *castel-*

A New Reagent for Gold.

Sergius Kern says: "Studying the action of sulphocyanates on some double salts of gold, I have found a remarkably delicate test for gold; experiments prove that even less than 1/100000 of a grain of gold may be easily detected by using my reagent."

The gold is first separated from foreign metals, and next converted by means of sodium chloride into sodio-gold chloride; the solution is then concentrated by evaporation. In order to detect gold, an aqueous solution of potassium sulphocyanide is used, containing for one part of the salts about 15 to 20 parts of water. About 92 grains of this solution are poured into a test tube, and some drops of the concentrated solution, obtained by treating the sample as described above, are added. If gold is present, a red orange turbidity is immediately obtained, which soon falls in the form of a precipitate; on gently heating the contents of the test tube, the precipitate dissolves and the solution turns colorless.

The reagent is so delicate that one drop of a solution of sodio-gold chloride (15 grains of the salt dissolved in 600 grains water) gives a very clear reaction.

This reaction showed the existence of very interesting double sulpho-cyanides of gold."—*Chemical News*.

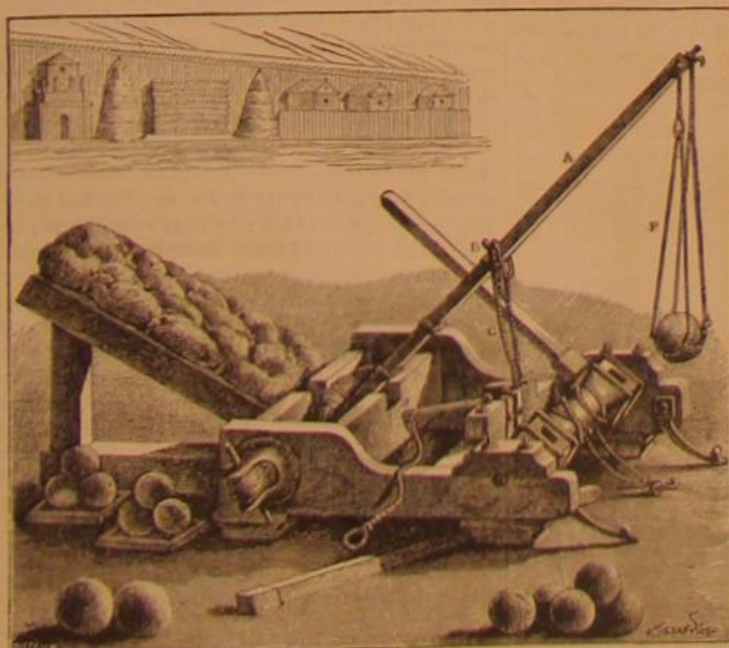
A New Electric Machine.

The apparatus, by S. C. Tisley, consists essentially of an electro-magnet with shoes, forming a groove in which a Siemens armature is made to revolve; this is much the same as the original machines made by Siemens and Wheatstone, but the difference occurs in the break or commutator; here there are two springs or rubbers employed in taking the current off from the commutator. The commutator consists of three rings; one of these rings is complete for three quarters of the circle, the other quarter being cut away; another ring is cut away three quarters, leaving the one quarter; and in between these two rings is a third ring, insulated and connected with the insulated end of the wire wound round the armature; on this center ring are projecting pieces, one a quarter of a circle and the other three quarters, so arranged as to complete the two outer circles. The rubber spring which comes into contact with the quarter of the middle circle is connected with the electro-magnet of the machine, and the armature is so arranged that at the time of contact the best magnetizing current is displayed. The other spring rubber is in connection with the wire on the armature during the other three quarters of its revolution; and this is connected with any external piece of apparatus required to be worked.

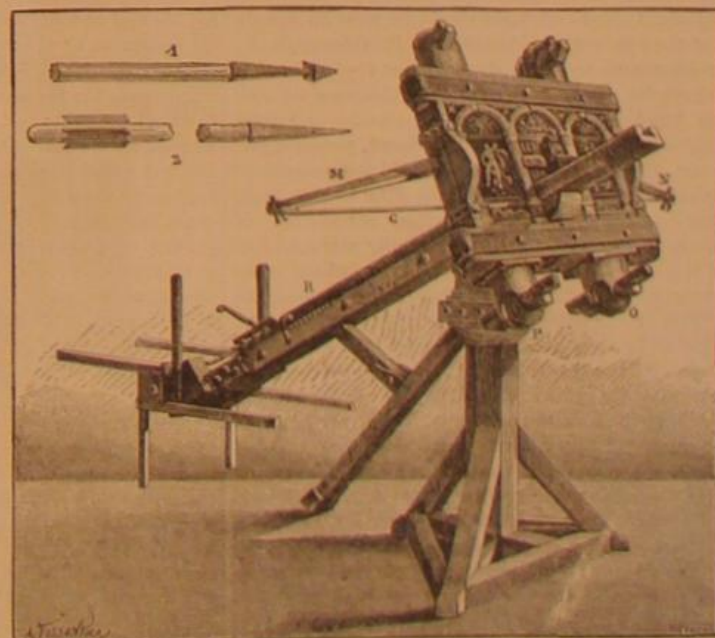
By this arrangement, the alternate currents being utilized, they are all in the same direction; and by the length of contact the whole of the current is obtained in the best condition for heating wires, decomposing water, giving an electric light, and other usual experiments.

At present a model machine has been constructed on this principle, the armature of which measures 5 inches long by 2 inches in diameter, on which is wound about 50 feet of cotton-covered copper wire, No. 16 B. W. G. The magnet has about 300 feet of covered copper wire, No. 14 B. W. G.; the whole instrument, without the driving gear, weighs 26 lbs.; with this apparatus 8 inches of platinum wire, of 0.005 inch diameter, can be made red hot, water is rapidly decomposed, etc.

The armature is constructed specially to prevent the ac-



THE ONAGER.



THE BALISTA

ROMAN WAR ENGINES

when, under the direction of M. Maitre, Director of the Museum, a series of experiments were conducted upon them in order to determine their power. The results obtained are of historical importance, since they enable us to form a good idea of the means of attack on which the armies, which dominated Europe eighteen hundred years ago, relied.

lum, which is analogous to the baronial castle of the middle ages; and the *burgi*, which were similar to but less important than the *castella*.

To fill holes in burrstones, use melted alum mixed with burrstone pulverized to the size of grains of sand.

cumulation of heat to which every class of dynamo-magneto-electric machine is liable. It is made in two halves, a groove of zigzag form being cast in each half; so that, when the two are screwed together, a continuous channel is maintained through the bearings for a current of cold water to pass during the whole time the machine is at work.

The Relation of Patents to the Various Industries.

We gave recently a *resumé* of a portion of Mr. J. A. Whitney's excellent address on the above topic. We continue our extracts below, commending them to the reader as of especial interest as showing the rise, progress, and profits of several of the most important American inventions:

"One of the most beneficent effects of the patent law is that, after it has caused a great invention to be made, it does not stop there, but leads to the production of many improvements upon it, the scope and value of the original invention being thus continually enlarged. It was so in a remarkable degree with the sewing machine; for this great invention owes nine tenths of its usefulness to scores of supplementary inventions that would never have been made if the patent laws had ceased with the fabrication of the first machines. Among these is the tuck creaser, a simple device patented fifteen years ago by Henry W. Fuller. The invention consisted in creasing or marking the cloth in lines parallel with the line of sewing, simultaneously with the operation of the needle, so that the making of one seam provided a guide, perfectly parallel with it, either for folding the fabric or for making the next seam. During the life of the patent fifty thousand of these creasers went into use in manufacturing establishments alone. The creasers were found on an average to last a year, or, to keep on the safe side, two hundred days of actual use. Each creaser would do three hundred yards of tucking per day, and this quantity was often doubled. A fair day's work without the creaser was one hundred yards; making the entire work done by one creaser in a year sixty thousand yards, worth three cents per yard, or a total of eighteen hundred dollars. The cost of the labor, including use of the sewing machine in which it was used, did not exceed four hundred dollars, leaving a net profit of fourteen hundred dollars. But as one third of this amount would be obtained by the same expense of labor, we must deduct this proportion, leaving a net profit from each creaser of \$933.33, and showing that, in manufacturing establishments alone, in the short period of fourteen years, there was a saving of human labor—a saving in the work of tired fingers and weary eyes—of forty-six million, six hundred and fifty thousand dollars. But this was not all. One million, two hundred of the creasers were sold to families during the same time, and whatever economy resulted from this greater number must be added to the public benefit conferred by the invention. While the cost of materials, etc., remained the same, this invention reduced the price of the finished article from four cents a yard to two cents. And there was the ruffle, patented by George B. Arnold, and known in the market as the 'magic ruffle.' This was a new article, and the patentee devised a new way of producing it. His invention shortened the labor of making such articles twenty fold, and provided a ruffle more uniform and better in quality than had previously been made by hand. In its manufacture only three operators were required to do the work of fifty, so that, with twenty dollars' worth of material, ruffles could be made, ready for market, at a cost of twenty-three dollars that otherwise would cost seventy. These inventions were worth to the public two millions of dollars a year. The patents during fourteen years brought in to the owners \$49,976.93, as proved from their accounts, to which must be added \$15,000 received from their foreign patents.

"The gimlet-pointed screw invented by Thomas J. Sloan has made the old variety as obsolete as the hammers of the neolithic age. This inventor secured a number of patents for machinery for making the screws, and the value of these adjunctive patents is illustrated by one of them, granted in 1851. This particular apparatus was simply for taking off the slight burr left by the saw used in cutting the nick or groove in the head of the screw. The production of wood screws at that date was ten thousand gross per day. Two hundred and eighty-eight of these machines were in use in the works of the Eagle Screw Company in Providence, R. I., and in fourteen years—the term of patents at that time—the invention effected a saving of ninety-seven thousand dollars. The double hand stamps for canceling stamps and post-marking letters by the same stroke of one hand, patented sixteen years ago, saved the government in 1866 the salaries of two hundred and fifty-four clerks at from \$700 to \$900 each, or more than two hundred thousand dollars per annum. A slight modification in the manner of joining wrought and cast iron in the manufacture of railings, patented the same year, saved one fourth of the usual expense of repairs, and during the term of the patent saved seventy thousand dollars to the public by the comparative freedom from corrosion and breakage. The subject matter of Aiken and Felthousen's patent of twenty-four years ago was the first machine to sew tubular goods, such as shirt sleeves, boot legs, etc., and in 1865 it was estimated that fifty thousand sewing machines, embracing one or the other of the features of this improvement were in use. No other sewing machine would do the work. One of these machines would save the labor of eight hands, and the invention added ten dollars to the value of any machine to which it was applied. The curved rest which formed one element of the invention was stated by sworn experts to save the community fifty thousand dollars a year in the manufacture of boots alone. But let me turn again to patents, the results of which have reached all over the world.

"We can all recall the time, not many years ago, when metallic or fixed ammunition was used in fire arms to only a limited extent; whereas, not only for army but for all other fire arms, it is now universally used. It was impossible to manufacture such cartridges, either of good quality or cheap enough to permit their use, until Ethan Allen's patent of 1860 disclosed a method which produced a revolution in fire arms throughout the civilized world. And how much did Allen receive during the term of fourteen years? He made,

in royalties and from the sale of a machine, thirteen thousand one hundred dollars. He also made a manufacturer's profit of forty cents a thousand on sixty-seven millions of the cartridges sold, not to the Government, but to the general trade, which was little enough in all conscience when we consider the importance of the invention.

"Perhaps a greater benefit was conferred upon the country and upon mankind through the patents upon which the manufacture of American Brussels and pile carpeting has been founded. Erastus Bigelow secured his first patent in 1837, and subsequently obtained many others, that of 1847 embracing the features that made the machine an absolute success in weaving carpet by the power loom. Bigelow had made, up to the year 1861, \$136,912.74 from these inventions. The history of Eli Whitney's cotton gin or Jethro Wood's iron plow show that it was the promise held out by the patent laws that led these men, through manifold trials, the one to open the way of this country to supremacy in the growth of the staple fiber of the world, the other to realize in sober fact the fairy tale of Scandinavian mythology, which told how a metal share added tenfold to the produce of the earth. Agriculture owes more than any other industry to the fostering spirit of the patent laws. And as the yield of the harvest begins with the turning of the furrow, perhaps the steel plow is the best illustration I can use in this connection. It was patented in 1864 by Francis F. Smith.

"Smith commenced business in Ohio, thirty-three years ago, as a blacksmith, and started his own shop in 1843. He sought to make improvements as early as 1850, and made two steel plows of sheet steel, by hand, in 1856. In 1859 he made numerous experiments in tempering sheet steel plows, but could not save more than one in three. In 1859 he was laid up by sickness, and learned by reading that steel could be cast to shape, but could get no satisfaction by enquiry until brought, by correspondence, into relations with the Collins Steel Company of Connecticut.

"The first cast steel plow was made and tried at Collinsville in July, 1860. Smith 'gave all his time, energies, and thought to the development of this plow' up to the seventeenth day of April, 1874. The number made and sold by the Collins Company was eighty thousand five hundred and sixty-nine. Smith, up to January 1, 1874, over and above money expended, but without allowing anything for his labor during these years, received about \$55,000. The Collins Company invested not less than two hundred and fifty thousand dollars in the manufacture and introduction of these plows; and the plows could not have been made at a price low enough to come within the reach of the farmer, neither could they have been introduced when made, without this large capital to pave the way. Cast iron plows are too soft to wear well in sand and grit; they will not scour in soft prairie or bottom lands. Plows made of sheet steel had been tried and been practically abandoned. Sheet steel plows are of flat plates; they do not have the greatest thickness at points of greatest wear; the plates tend to constantly renew their former flat form. The parts cannot be made uniform, cannot be readily duplicated or repaired, and will not admit of high temper and hardness; for tempering and hardening warp, and twist or crack, and spoil the sheet. All these defects are obviated in the cast steel plow. The worth to the farmer in increased durability, aside from scouring, estimated by sworn experts at five dollars per plow over and above common plows, after making allowance for difference in the prices at which they were sold—80,500 plows, with an increased value of five dollars each—is upwards of four hundred thousand dollars gained by the farmers of the West, while the inventor made less than one seventh of this amount.

"But a greater than the steel plow was McCormick's reaper; for his reel and divider made grain-harvesting a success. In the extension of these patents it was shown by sworn evidence that, in those districts of the West where reapers were introduced, the increase in the production of grain was one hundred per cent; for the labor of those regions could not harvest by the old methods more than one half of what the soil was capable of yielding. The work of sewing is one half easier than that of reaping; so that, if all was sown that could be, one half of the crop would have had to rot on the ground. On an average each machine cut, during each year of its lifetime of ten years, two hundred acres, or a total of two thousand acres. Hence it was that each machine saved to the user, in labor alone, at least five hundred dollars, besides paying its original cost; and in this way, up to 1859, the saving of labor to the public amounted to thirty-six millions six hundred thousand dollars. The gain to the public in the increase of the grain crop, due to the invention, to the same date, was one hundred millions of dollars. McCormick's patents were dated 1834, 1845, and 1847; but up to the year 1859 he had devoted twenty-seven years to his improvements. During this time he paid out one million, eight hundred and sixty-five thousand, two hundred and seventy-eight dollars. His receipts, exclusive of bad debts and costs of collection, were \$2,527,698, leaving him a clear profit of \$662,414. This included both manufacturer's profits and royalties. But the devices that would cut the upright hollow stalks of grain were unsatisfactory when applied to cutting the more slender and fibrous stems and the yielding leaves of grass; and the sickle bar, playing through slots in the guard fingers closed at both ends, clogged so that no successful machine for cutting grass was made before Eliakim R. Forbush, in 1849, patented his guard finger with the open slot. This enabled the knives to clean themselves, and effectually avoided clogging. This was applied to various machines that needed nothing more to fit them for cutting grass. The inventor was modest enough to estimate the value of

this improvement at two dollars for each machine, although no machine that would successfully cut fine grass had ever been used before. Twelve years ago the number of mowing machines sold in one season was twenty-five thousand, or a gain to the farming community from this device of fifty thousand dollars annually. Forbush was unfortunate; and while the public was making this, he delivered, during the original term of his patent, just twenty-five dollars and ninety cents per annum.

"After machines had been made to reap, and other machines had been made to mow, it still remained to provide a machine that would do both. There were numerous attempts to do this before John H. Manny's patent of 1851, but none had succeeded. Before this two distinct machines were required for the two kinds of work, at a cost of from \$235 to \$270, or an average of \$250 for the two. Manny sold a machine, equally efficient for both kinds of work, for \$135, saving \$115 to the purchaser of each of his machines. There were made and sold under this patent of 1851 sixty thousand machines, saving to the farmers in fourteen years, in this matter of first cost alone, six million nine hundred thousand dollars. But this is not all. Manny made the cutter bars of his machine so readily adjustable that they could be raised or lowered to cut lodged grain, the lodged grain being picked up by the bar, cut, and saved. The loss from lodging has been frequently estimated at several bushels per acre; but at only half a bushel per acre, at eighty cents to the bushel, a machine cutting ten acres a day, the saving amounts to four dollars a day for every day a machine is used. Assuming each machine to be used only twelve days each year, the saving amounts to forty-eight dollars for each machine per annum. These machines, with usual wear and tear, were found to last eight years—a shorter time than McCormick's, because they mowed as well as reaped. Eight times forty-eight dollars is \$384, and the sixty thousand machines saved in lodged grain alone \$23,040,000. Add to this the saving in first cost of machines, and Manny's inventions saved to the agricultural community in fourteen years within a fraction of thirty millions of dollars. Manny secured no less than thirteen patents, from which he made altogether a trifle more than \$283,000, including his profits as a manufacturer, or less than one per cent of what the farmers had gained from them during the same time. But Manny's profits, like those of every other inventor, ceased when his patents expired. But the public, with these, as with all other inventions, has their benefits for all time; and the same rule holds good for small inventions. In 1861 Nathan Brand patented a machine for making hoes by rolling instead of forging the plates. This reduced the cost from twelve to nine dollars a dozen; and there are one hundred thousand dozen hoes made and sold annually in the United States. Brand made from it, over and above the expense of his experiments, three thousand six hundred dollars.

A Silver Bath from Ditch Water.

"All our formulae tell us to use pure water in making up our silver solutions. I was led into a discussion, a short time since, with a brother photographer on this one point of our manipulation, and it finally led to a small wager that I could not make a bath with such water as he might furnish, the first plate exposed in the bath to give a good negative.

"The water came; it was evidently such as he had dipped up from some bog puddle—muddy, greasy, and in every way filthy; and from this stuff I was to make a half gallon of silver bath which would work from the start. I commenced my labors, and had one week to finish the undertaking. First, I let the mud settle in the bucket in which I received the water, skimming off the green mass and the grease which floated on the surface. After leaving it a few hours to settle, I carefully decanted the liquid into a tall glass candy jar, and found I had about one gallon of stagnant water, anything but inviting for the purposes intended. I let it stand over night, and, for a result, had about half an inch of settlements in the bottom of the jar. I again decanted into another clean jar the liquid from the mud, and I had a little less than three quarts of water. I now added half an ounce of nitrate of silver, which turned the liquid brown before it was half dissolved. I placed the jar in the sun for one day, and in an hour it was black as ink; by next morning it showed signs of clearing up, and I again decanted the clear solution. I filtered it carefully, and made my bath by adding nitrate of silver sufficient to bring it up to forty grains strength, adding one and a half grains of iodide potassium for each ounce of silver used, shaking thoroughly. I put the bath in the sun, and left it for two days, when the solution was perfectly clear. I filtered through prepared cotton, and finally added chemically pure nitric acid until blue litmus paper turned slightly red. Placing the solution in my bath tub, I coated a plate with collodion, and left it in the bath over night. The result was that the first plate dipped in the bath and exposed in the camera gave a fine negative."—F. J. K., in *Western Photographic News*.

A Captive Gorilla.

The rather curious discovery has been made of a living gorilla among the apes in the Zoological Gardens of Dresden. The animal was purchased while quite young as a chimpanzee and an unhealthy one at that. As it became older, its development attracted general attention, and finally Dr. Schweinfurth, the African traveler, after examination, pronounced it a genuine gorilla. It is the first of the species that has been kept alive in captivity; and as it now appears to be doing well, there is a probability that it will reach maturity, and thus enable zoologists to make important studies regarding its now little known habits and characteristics.

Useful Recipes for the Shop, the Household, and the Farm.

The grindstone is a self-sharpening tool; and after having been turned in one direction for some time (if a hard stone), the motion should be reversed. Sand of the right grit applied occasionally to a hard stone will improve it.

To remove rust from small hollow castings, dip in dilute sulphuric acid (1 part commercial acid to 10 of water). Wash in hot lime water and dry in a tumbler in dry sawdust.

To remove chuck cement from lathe work, warm the object over a spirit lamp and tap lightly with a stiff brush: the wax will adhere to the latter. If in a hurry, a few seconds' boiling in alcohol will remove the remainder of the wax.

Exhaust steam should never be discharged into a brick chimney. It is liable to disintegrate the mortar and thus to render the entire structure unstable.

A mortar celebrated for its durability is composed of well slaked lime mingled with finely sifted sand. To this is added one quarter as much fine unslaked lime as there has been sand used. While it is being mixed, the mass heats, and the mortar should then be immediately used. The substance is waterproof and becomes excessively hard.

Salmon skin makes a leather of about the thickness of dog-skin and as tough as wash leather. The scale marks leave a neat pattern.

The finest glass enamels are generally prepared by fusing (at a high temperature) silica, oxide of tin, and oxide of lead, and spreading the mixture over a sheet of copper, of gold, or of platinum. A much more economical and as efficient a compound consists of arsenic 30 parts by weight; saltpetre 30 parts; silica 90 parts; litharge 250 parts. This is spread on plates of glass of the required shape and size, care being taken, however, that the kind of glass employed be not less fusible than the enamel. Enamelled gears thus prepared may be drawn or written upon as readily as paper, and in less than one minute the writing may be rendered indelible by simply heating the plate in a small open furnace or muffle.

Hydraulic cement mixed with oil is recommended as a paint for concrete brick walls. The same is a good waterproof paint for roofs and walls of cisterns.

The French (St. Gobain) glass, used for lighthouses, is composed of silicic acid 72.1 parts; soda, 12.2 parts; lime, 15.7 parts; alumina and oxide of iron, traces. Birmingham glass is made of French sand 5 cwt.; carbonate of soda, 1 cwt., 3 quarters, 7 lbs.; lime 2 quarters, 7 lbs.; nitrate of soda, 1 quarter; arsenious acid, 3 lbs. The best qualities of this glass are at present produced in the Siemens furnace.

The following are good colored glazings for potter's use; White: Massicot 4 parts; tin ashes 2 parts; fragments of crystal glass 3 parts; sea salt $\frac{1}{2}$ part. Melt in earthenware vessels, when the liquid flux may be used. Yellow: Equal parts of massicot, red lead, and sulphuret of antimony. Calcine the mixture and reduce it again to powder; add then pure sand 2 parts and salt $\frac{1}{2}$ part. Melt the whole. Green: Sand, 2 parts; massicot, 3 parts; salt 1 part, and copper scales according to the shade to be produced. The mixture is melted as directed above. Violet: Massicot 1 part; sand, 3 parts; smalt 1 part; black oxide of manganese $\frac{1}{2}$ part. Blue: white sand and massicot, equal parts; blue smalt $\frac{1}{2}$ part. Black: Black oxide of manganese, 2 parts; smalt 1 part; burned quartz $\frac{1}{2}$ part; massicot $\frac{1}{2}$ part. Brown: Fragments of green bottle glass, 1 part; manganese 1 part; lead glass 2 parts.

It has been observed that old charcoal burns more energetically than recent, because the former has absorbed oxygen from the air, a circumstance which has been practically utilized with advantage in refining crude iron.

New linen may be embroidered more easily by rubbing it over with fine white soap. It prevents the threads from cracking.

The Southern States Agricultural and Industrial Exposition.

The attention of the reader is directed to the announcement of the Southern States Agricultural and Industrial Exposition, which appears on our advertising pages. This fair opens in New Orleans on February 26, 1876, and continues for ten days. Competition for very attractive premiums is asked from all parts of the United States, Mexico, and Central America, and special prizes are to be awarded for strictly southern products.

The industries of the south are now rapidly advancing, and that section of the country now offers a valuable field for the sale of improved machines and inventions of every description. To manufacturers of agricultural implements, cotton presses, machinery and apparatus for making cotton seed oil, and improved devices for tobacco and sugar culture and preparation, we have no doubt but that the above exposition will prove very profitable. The same may be said as regards builders of steam engines, and particularly small motors, portable and otherwise, for plantation and factory use. It will be observed that the display is to take place during a period when no similar exhibitions are in progress, and between the closing of the fall fairs and the opening of the Centennial, so that those who have contributed to the former, and who intend exhibiting at the latter, might easily send their articles to New Orleans during the intervening time.

Poisoning by Arsenical Wall Paper.

Cases of arsenical poisoning occasioned by living in rooms, the walls of which are covered with paper colored green by arsenite of copper, have frequently been recorded. Lately, a case of arsenical poisoning has come under my notice," writes Professor Cameron, "caused by inhaling the dust from paper not colored green. The family of a gentleman, Mr. Jones, residing at New Ross, suffered so severely from symptoms us-

ually produced by arsenic that he was induced to get the wall paper of his house examined. Out of seven kinds of paper six were found to contain arsenic. No. 1, an olive green paper, with deep green flowers and gold-like lines, contained an immense amount of arsenic in the two green colors and the gold. No. 2, a faint lavender watered paper, contained arsenic in large amount. No. 3, a white paper with gray flowers, contained a very large amount of arsenic. No. 4, a paper with red and green flowers on a gray ground, was highly arsenical. No. 5, a dark olive-colored paper, with gilding, did not contain much arsenic. No. 6, a pale green and white paper, also contained only a small amount of arsenic, much less than was put on the lavender paper. Mr. Jones's family had not suffered from the symptoms of arsenical poisoning until shortly after the house was papered with the above, and the symptoms disappeared shortly after they left the house preparatory to the removal of the paper."—*Medical Press and Circular*.

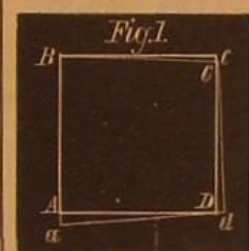
LAYING OFF A SQUARE.

In a letter recently received, a correspondent asks an explanation of the following difficulty:

He wants to get out a square board, 6 inches on a side. He first dresses one edge of the stuff true; and having proved his try square, he applies it to this edge, lays off one corner, and works it to the line; then he makes the new edge 6 inches long, applies his try square, and lays off a second right angle, and so proceeds. When he reaches the starting point, he finds that the last angle is not a right angle, and he wishes to be told the reason of this.

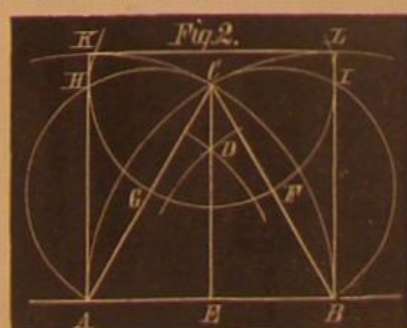
Many a young mechanic, on his promotion to the vise bench, is confronted with this difficulty, on trying to square up a nut with the aid of a try square; but not many, it is probable, know the reason, so perhaps a few remarks on the subject may not be out of place.

It must be evident to any one that, if the first three corners of a piece of stuff are square with absolute precision, the last corner must necessarily be square also, but it may not be so obvious that a slight error in each of the first three corners will be greatly magnified in the fourth. This can be made plain, however, by a little study of Fig. 1.



Suppose the workman starts on a straight edge, A B, and applies his square at B, laying off what he thinks to be a right angle; but partly from the error in the line, and partly from want of accuracy in working to the line, he actually makes the angle at the corner, B, A B c, which exceeds a right angle by the angle, c B C. Proceeding to the corner, c, he works out a second angle, B c which is as much in excess of a right angle as the first, but about twice as much in excess of the true angle of the corner, B C D. At the third corner, the angle, c d a, is worked out, only exceeding a right angle by the angle C b c, as in the first case, but having about three times this excess over the true angle of the third corner, C D A. This shows where the difficulty lies: the three corners, B, c, d, are each only a little out of square but the corner, a, has three times the error, and any error, however small, if multiplied considerably, becomes very noticeable. In the figure the error is purposely made quite large for the sake of clearly illustrating the point; but even in this aggravated case, the errors in the corners, B, c, d, seem trifling in comparison with that of the corner, a.

Having shown the error that is likely to arise from the use of the try square for cases of this kind, it is perhaps only fair to point out a more excellent way. Since the trouble is caused by the multiplication of errors from corner to corner, and since experience shows that work of absolute precision is rarely accomplished with ordinary tools, it will be better to divide the errors equally among all the corners, if possible, in laying out the square. One method of accomplishing this is shown in Fig. 2. It needs for its execution



a straight edge, a pair of dividers with well sharpened points, and a fine scriber. Having worked one edge true or drawn a straight line, lay off on it a distance, A B, equal to one side of the proposed square. With A and B as centers, and with A B as a radius, describe two arcs, intersecting at the point, C. With the same points, A and B, as centers and with a radius less than A B, describe two arcs, intersecting at the point, D. Draw a straight line through the points, C and D, cutting the line, A B, at the point, E. E is the center point of the line, A B. Join the points, A and C, by the straight line, A C, and the points, B and C, by the straight line, B C. With C as a center, and with a radius equal to A E or E B, describe an arc, cutting the lines, A C and B C, in the points, G and F, respectively. With F as a center, and A E or E B as a radius, draw an arc, cutting the former circle in the point, I; and with G as a center, and the same radius, describe an arc, cutting this circle

in the point, H. Draw a straight line through the points, B and I, cutting the arc drawn from B, in the point, L; draw also a straight line through the points, A and H, cutting the arc drawn from A, in the point, K. Join the points, K and L, by a straight line, and the square will be complete; and any errors of construction will probably be evenly divided among the four corners, if care is used in drawing the lines. It is possible, also, to check the accuracy of the construction at different stages. Thus, the straight line drawn through the points, C and D, should bisect the line, A B, and this can readily be tested with the dividers. Also the circle drawn with C, as a center, and with a radius, A E or E B, should cut the lines, A C and B C, at their middle points.

Specific Heat.

Suppose we take two vessels, the one containing 1 lb. of water and the other 10 lbs. of water, and expose them to such a source of heat that equal amounts of heat will enter each vessel at equal intervals of time, we shall find that, when the temperature of the 1 lb. of water has risen to 10°, that of the 10 lb. will have risen only 1°. Now as ten units of heat have entered each vessel, it follows that it requires ten times as much heat to raise 10 lbs. of water 1°, as it does to raise 1 lb. of water the same amount; and as similar results are obtained with other substances, we may conclude that the amount of heat, required to raise different weights of the same substance 1°, must be proportional to these weights. Now suppose we take four vessels, containing respectively 1 lb. of water, 1 lb. of mercury, 1 lb. of silver, and 1 lb. of iron, and, as before, expose them to such a source of heat that each substance in the same intervals of time will receive the same amount of heat. Having placed a thermometer in each vessel, upon observation we shall find that, when the water has risen 1°, or, in other words, when it has received one unit of heat, the other substances will indicate a much higher temperature, as shown in the following table. We there find that one unit of heat will raise a pound of mercury 30°; consequently, it will only require $\frac{1}{30}$ or 0.033 of a unit to raise it 1°. In this manner, by taking water as unity, we can determine the fractional part of this unit required to raise equal weights of any other substances 1°. This fractional part, which is shown in the third column, is called the specific heat of the substance.

Name of Substance.	Temperature, with Application of one Unit of Heat.	Specific Heat.
Water.....	1-0°	1.000 = $\frac{1}{1}$
Iron.....	8-8°	0.114 = $\frac{1}{8.8}$
Silver.....	17-5°	0.057 = $\frac{1}{17.5}$
Mercury.....	30-0°	0.033 = $\frac{1}{30}$

From the above table we also learn that, at the same temperature, water contains 8.8 times as much heat as the same weight of iron; 17.5 times as much as the same weight of silver; or 30 times as much as the same weight of mercury. If we were to examine a more extended table of specific heats, we should find that water, at the same temperature and at equal weights, contains more heat than any other known substance; and for this reason, the specific heat of different substances is always expressed by the fraction obtained by comparing the amount of heat required to raise 1 lb. of the substance 1° to that required to raise 1 lb. of water 1°.—*Engineering*.

Long Rails.

During the recent celebration at Darlington of the fiftieth anniversary of the opening of the first passenger railway, the Britannia Iron Works Company, at their works at the neighboring town of Middlesborough, rolled for the inspection of visitors some rails of unprecedented length, and it is proposed to place one of them, 130 feet long, near the first locomotive engine, opposite the Darlington station, as a memorial of the jubilee. During the same week this company rolled in one mill, 1,350 tons of rails 40 lbs. per yard, a quantity which it is believed has never been even approached in any other mill in the same space of time. The rails were for the New Zealand Government Railways.

Substitute for the Liquid Prism.

A new method of determining rapidly the index of refraction of liquids is given by MM. Terquem and Tannin in a recent number of the *Journal de Physique*. It is based on the fact that when a sheet of air, enclosed between two plates of glass, is placed in a liquid, parallel luminous rays striking this sheet obliquely are totally reflected at the limited angle of the liquid with reference to the air. It is sufficient then measure this angle, and one has all the necessary data for calculation of the index. The authors describe two different arrangements of the apparatus, and compare some of their results obtained by it with those of Fraunhofer and of Messrs. Dale and Gladstone, showing close correspondence. The method is quicker than that of the liquid prism; the cleaning of the small vessel is very easy; one has not to be preoccupied with the angle of a prism and the exact verticality of its surfaces; and lastly, the temperature of the liquid is more easily determined.

WE understand that Mr. Hughes, of Cincinnati, O., formerly of the firm of Hughes & Foster, is now making for use of the Defence Association a model of a planing machine with yielding pressure bars, such as were used in 1843, three years before the Woodbury Company date their claim to the invention.

IMPROVED ODORLESS WATER CLOSET.

It is just now beginning to be understood that the results of defective drainage are pestilence and death, and, moreover, that many of the safeguards, hitherto relied upon as protections, are in fact no defense whatever. Into the public sewers all kinds of excrementitious matters, waste, and offal, are deposited, along with abundance of water, and the whole is exposed to a temperature favorable to fermentation. The offensive sewer gas is the product, which seeks to escape from its confinement in the sewer by every practicable outlet. The only protection against this escape, commonly employed, is the water-sealed trap, usually in the form of an *U*, the lower bend of which is supposed to be constantly filled with water, and to prevent the passage of sewer gas. It is known, however, that a pressure of two ounces or less per square inch is sufficient to displace the water in any trap, and this small pressure is frequently exceeded by the gases confined in the pipes. Such augmented pressure may be produced by the influx of a stream of water, by the variation of temperature caused by the entrance of hot water, by wind blowing into the open mouth of the sewer, or by the backing in of tide water, by flushing, etc. In addition to these are other causes capable of unsealing traps, as the disturbances of pneumatic pressure in flushing some distant part of the pipe, siphoning by portions of some textile fabric, as a cord, string, or rag washed partly out of the trap, evaporation, etc. The presence of the characteristic smell in the vicinity of a water-closet denotes that some one of these causes is at work, forcing or aiding the escape of the gas from the opening of the waste pipes.

Traps are designed to suppress and keep in confinement the gaseous products of sewer decomposition. We have repeatedly pointed out, however, the defects of the trap system, and have also expressed the opinion that the best precaution is found in properly directed ventilation, by which the noxious exhalations will be harmlessly carried away. We are therefore able to pronounce favorably upon the invention herewith illustrated, which is based upon the ventilating principle, and in which the bowl of the water closet is directly connected with a chimney or other flue, through which a draft of air will be caused to flow upward and be discharged above the house top. It will be perceived that this arrangement merely constitutes a siphon, the long leg of which is the flue and the short leg the bowl of the water-closet, and that the well known siphon action must ensue. The effect, we are informed, is a complete and perfect prevention of the escape into the apartment of any gas or odor from the soil pipe or interior of the container. This effect is well represented by the arrows in the engraving, the regular ones denoting the flow of pure air, and the crooked ones denoting sewer gas or foul smells. With these closets traps may be advantageously dispensed with, because whatever sewer gas comes to the container will go up the chimney instead of into the apartment, and its presence is immaterial. Besides, with a free outlet of escape at every closet, there could be no accumulation of such gas, and the work of disposing of it would be constantly going on.

These closets are in successful use in the cities of Washington, Baltimore, Cincinnati, Chicago, and elsewhere, and in no instance have they failed to give entire satisfaction. The inventor guarantees them to be perfectly odorless in every instance, if properly set.

With reference to the liability of a down draft in the chimney to cause an overflow of gas, the inventor says that he has not yet encountered any such effect in a well constructed chimney into which air could enter anywhere below the top, and that if the chimney does not draw properly it is simply a case for correction, and must be made to draw. There are also several minor points of improvement worth noticing. The container is placed upon legs, which gives the plumber access to the soil pipe joint, and enables him to caulk it tightly without trouble. The cover is fitted with a rib entering a groove in the rim, so as to insure a tight joint there, with but little material. The bowl is bedded in putty or cement under the flange and down beside the neck for an inch or more, which insures for it a very firm seat.

Patents for this invention have been granted to R. D. O. Smith, 613 Seventh street, Washington, D. C., to whom inquiries for further information should be addressed.

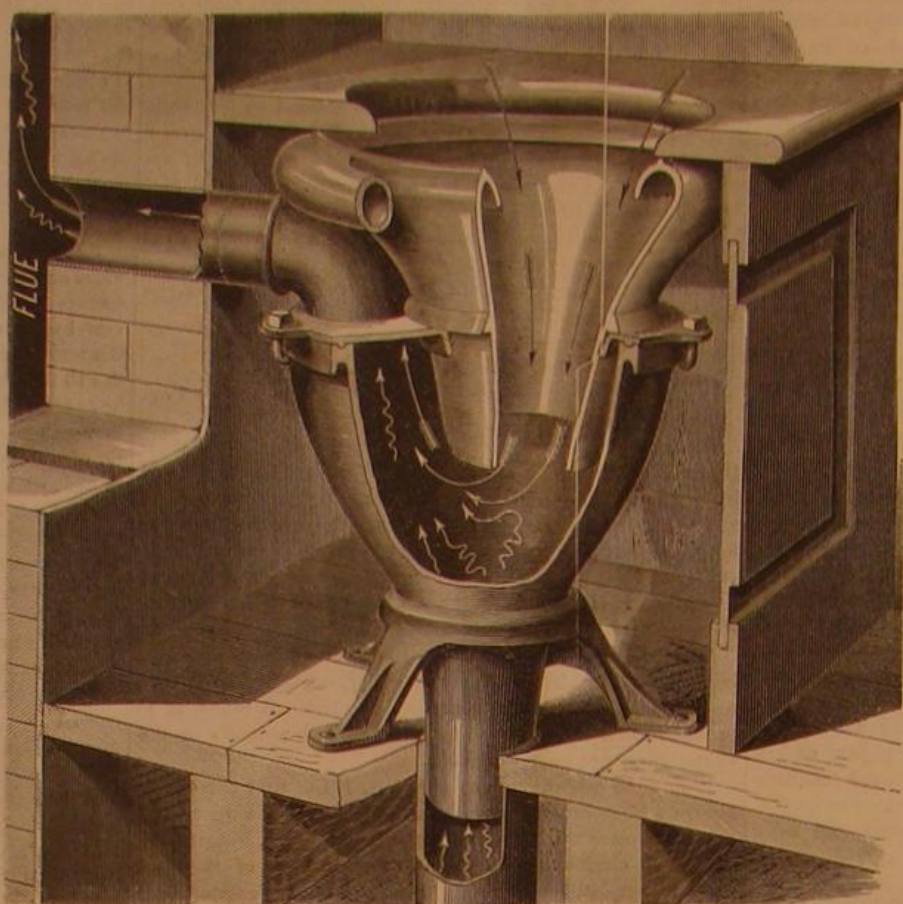
HALE'S DUPLEX WATER ELEVATOR.

We represent in the annexed engraving a new elevator, the motive power for which is obtained, first from the weight of a column of water, and, second, from the normal pressure of the atmosphere. These forces are applied to raise the carriage through the medium of a piston traveling in a vertical tube, and in connection with suitable hoisting apparatus.

By these means a machine, simple in construction, is produced, and at the same time one claimed to possess the important advantages of cheapness, safety, certainty, and smoothness of action. There are various ways of applying the power above named, different from the plan here illustrated, and of which the manufacturers have likewise availed themselves; but to these it is not deemed necessary to make other than this passing reference, since the reader will obtain

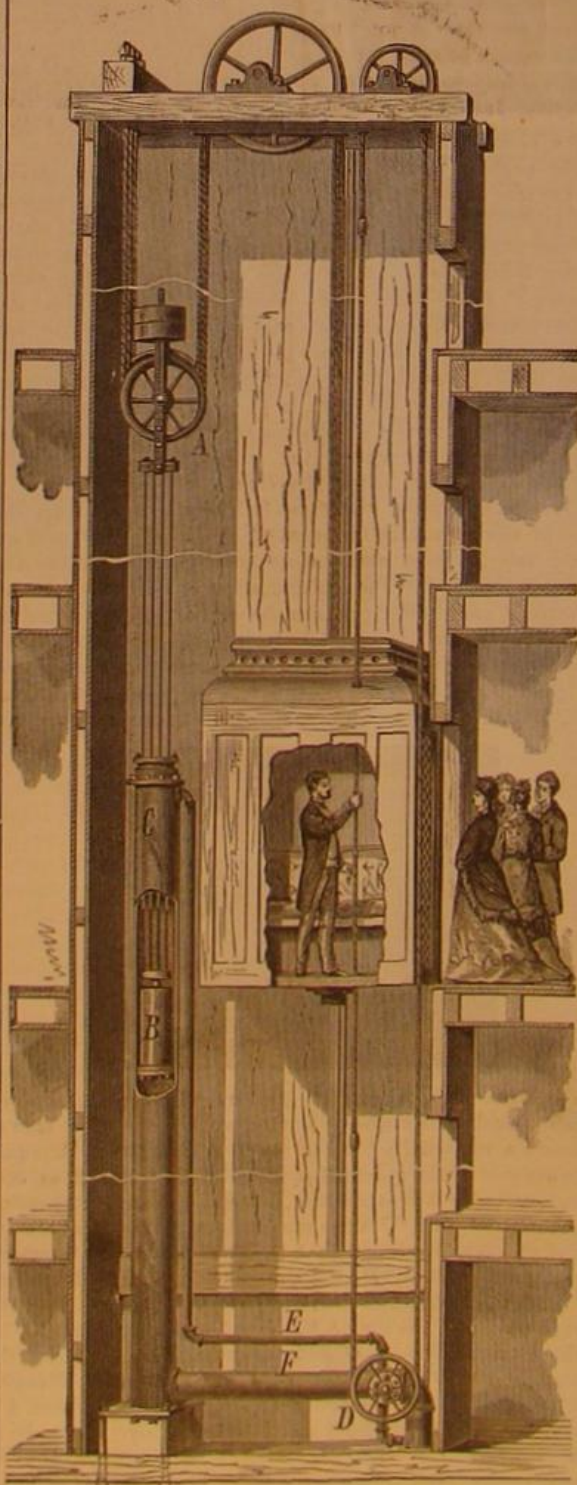
a good idea of the principle upon which all are based from the present engraving and description.

The carriage is secured by several ropes which pass up over a fixed pulley wheel, thence to a weighted gin block, A, and their standing parts are secured above, as shown. The



SMITH'S ODORLESS WATER CLOSET.

weight on the block, A, together with the piston, B, constitute a counterpoise for the carriage. The piston, B, is attached to the gin block and traverses the tube, C. When



HALE'S DUPLEX WATER ELEVATOR.

the carriage is at the lowest point of its course, the piston is at the upper end of the tube. To cause the carriage to rise, the rope, passing through it and shown in the hands of the figure, is pulled, thus opening a valve at D, which admits water through the pipe, E, on top of the piston, and at the same time opens an exit pipe, F, for the water already in the tube below the piston. Since the weight of the carriage itself is compensated for by the counterpoise already mentioned, the resistance to be overcome reduces itself to the load added plus the inertia of the various parts. Against this we have, first, the weight of the air, 15 lbs. per square inch above the piston. This is obviously gained through the escape of the water below, the tube giving a column of the latter about thirty-three feet in height. Second, the absolute weight of the water itself acting on said piston; and, third, as a variable force dependent upon outside circumstances, the pressure of water which may exist in city mains or may be due to difference of level between the top of the tube and a tank located in the upper story of the building. The result of this condition is necessarily the descent of the piston and the elevation of the carriage, the water below the piston mean while escaping into the sewers or being led into a tank, from which it may be raised by any suitable means to the tank in the upper story, and so be used over again.

To lower the carriage, no outside power is called into use, a point of advantage of this system over steam elevators, which require a large expenditure of steam to hold the load in descending. The valve rope is pulled so as to set the valve, at D, in the opposite direction, so that the water now enters beneath the piston, passes again through F, and escapes through E. The carriage then sinks slowly and noiselessly, without jar or shake.

That this invention is economical, as compared with steam elevators, will be generally obvious. There is no engine or boiler, requiring care, fuel, and repairs, and in fact there is no reason why, after the apparatus is once constructed of good durable material, it should not last until worn out, at no further expense save that of the water used, as determined per meter, or at that involved in the pumping of the water from the lower to the upper story. It is easy to operate, it stops automatically at the top and bottom of its course, it includes devices (not here represented) for graduating the power employed in proportion to the load, and safety appliances for preventing its fall in case of accident to the hoisting gear.

The invention is covered by six patents, the latest dated April 20, 1875. For further information address the manufacturers, Messrs. W. E. Hale & Co., 56 and 58 Park Place, New York city, or 107 and 109 Lake street, Chicago, Ill.

A Collodion Polarizer.

In the *Archiv* Dr. Schnauss says that for some years he has used small bags prepared from thick collodion in his dialytic and endosmotic researches, and that, latterly, Herr Grippon has employed collodion film peeled off clean glass plates in his experiments with polarized light and the radiation of heat. The collodion film polarizes reflected as well as transmitted light, provided the thickness of the skin be, by exact microscopic measurements, between 0.00333 inch, in which case the angle of the greatest polarization would be $38^{\circ} 55'$, and its reckoning index $= 1.5108$. The skin allows 0.91 of the heat radiating from a luminous source of heat to be transmitted, while a darkened vessel with boiling water only allows 0.70 to pass through; but if the heat radiating from the water be but 50° , then only 0.50 passes through.

From this it will be seen that the radiation from a vessel producing 100° of heat, when transmitted through two superposed collodion skins, still retains 0.583° of heat. Further, the greater transparency of collodion renders it a suitable substitute for mica in producing polarization, and the ease with which it can be prepared counterbalances the greater durability of the mica; and its great dia-thermometric powers recommend it as a vehicle for experimenting upon the radiation of heat.

The War Kite.

Mr. Simmons, the aeronaut, who is the inventor and patentee of a machine named the parakite, lately made a somewhat successful experiment with this invention at the Alexandra Palace, London. The machine used on this occasion was 30 feet high and 30 feet wide. As soon as the sail was fixed over the framework, and the front or windward point of the parakite was raised so as to allow the wind to touch the machine on its under surface, it was instantly converted into a concave form and showed symptoms of rising. The wind was blowing at the rate of not more than two miles an hour; but with this slight breeze Mr. Simmons was carried into the air. We understand that these experiments will be repeated a few times previously to public demonstrations; and should they continue to be successful, the invention can be put to practical utility for war purposes, engineering, and signaling, where it is necessary to attain lofty elevations. The machine above referred to covers an area of 700 superficial feet, and its entire weight is 100 lbs. The inventor asserts that it can be used successfully in any wind ranging between 4 and 40 miles an hour, and an altitude of from 600 to 1,000 feet can be attained.

PRODUCTION OF HEAT AND LIGHT.

On page 290 of our volume XXXII., we illustrated and described an invention of Mr. Cowan, a Scotch gentleman, combining a hot water heating apparatus with a limekiln or small gas works. The system seems to be likely to come into extensive use in Europe, a company being already formed for bringing it into operation; and they have recently purchased a vineyard at Garston, near Liverpool, containing six acres of ground, which is nearly all covered with glass, and in which four miles of iron piping is employed for heating purposes. We publish an engraving of this establishment, which is now heated entirely by surplus heat from limekilns, although till recently 16 hot water boilers were employed, at a considerable expense for fuel. A correspondent of the *Agricultural Gazette*, from the pages of which we select the engraving, recently visited the place; and he states that, although the limestone has to come by rail, and costs about \$2 a ton, the vineyard is heated nearly free of cost, the lime sold paying the expenses. Lime burning is as suitable a process for combining with the heating as the making of gas; for lime is as necessary to the farmer as to the builder. Moreover, if a large area of hothouses could be used, gas to supply the adjoining villages, lime for the whole neighborhood, and warmth for the cattle sheds in winter could all be furnished.

A writer in the *English Farmer* states that "a large party met and spent a day or two, and some of them a night or two, in the Garston vineyard. After the most careful inspection, it is a satisfaction to be able to add that the heating was most satisfactory. The limekilns gave out a powerful steady heat, warming the pipes easily to temperatures ranging from 100° to 140°, according to the distance from the kilns. These temperatures are absolutely sufficient for all horticultural purposes. The new system entirely abolishes the anxieties of night or day stocking. It is only needful to charge the kiln once in 12 or 24 hours, and the joint combustion of the limestone and fuel will maintain the temperature steadily, without varying hardly 5°."

"Neither can there be a doubt about the economy of the limekiln heating. Several gentlemen who have had it in operation for two years declared that the entire cost of the fuel was defrayed by the lime sold."

"The company have also added cheap lighting to the heating of horticultural and all other buildings. The vineyard is already lighted with gas made by placing a retort over the limekiln. This adds to the heating power of the kiln, as the conversion of the coal in the retort into coke and gas gives off additional heat, which is at once absorbed by the boiler astride of both."

"It may not be possible for many or any of our readers to erect a kiln for themselves to light and warm their villa premises, hothouses, or gardens. But villas are often built in blocks, and large numbers of them are not seldom placed within easy reach of each other. Surely in such cases it might be possible to have a common kiln erected, and heat and gas conveyed to all who wanted them, at a remunerative rate. There need be very little more difficulty in conveying hot water to hothouses or mansions than there is in taking coal or gas. Of course there must needs be a double line of pipes, a flow and a return, and some means would have to be used to keep the water warm on its passage. But all these are matters of detail that would be more than compensated by the simplicity of merely turning a tap on when heat was wanted, and turning it off when it was not."

THE YUCCA STRICTA.

Nearly all the hardy species of yucca inhabit the shifting sands of the seashores of northeast America, from Virginia southward to Florida, and, therefore, they are admirably adapted for planting in similar situations; but they will flourish in any thoroughly drained, free soil, open sunny places suiting them best. They grow rapidly and flower freely in gravelly soil, and we have also seen them doing well on various sand formations, and on the chalk; but they thrive best of all on a deep alluvial soil.

For the rock garden, for massing on knolls, for planting singly, for association with other plants with ornamental foliage, for planting in formal gardens, and for a variety of other purposes, the yuccas

stand unrivaled. Although loving a deep free soil, especially where there is moisture below, they will succeed in a stiff loam; but in a heavy soil, slightly raised mounds should be selected, or they are liable to suffer in winter, and rarely flower. In very dry seasons they should be liberally watered; this promotes growth and the production of flowers; but yuccas will bear a long drought without actual injury. This may be verified where small garden plots are drained completely dry, and where rain runs off the ground unless the precaution is taken of keeping the surface moved. Nevertheless, yuccas should be extensively planted in towns, not

branches of the panicles are long, and bear as many as dozen flowers, and the latter are comparatively large. *Yucca stricta* is described in *La Revue Horticole* as a short stemmed plant which, at the surface of the soil, presents a spherical mass of leaves, which are very numerous, and measure some 16 or 17 inches in length, and about half an inch in breadth. They taper off to a point, are straight or sometimes a little bent, slightly canaliculated, and bear upon their edges whitish gray filaments; the youngest leaves are somewhat shorter and broader than the others, and are glaucous on the interior surface. The flower spike is green,

pubescent, and strong, attaining a height of 3 or 4 feet. The twin flowers, which are often solitary on weak stems, are at first greenish, then yellow, and subsequently nearly white. The external divisions are about 1½ inches long, and three quarters of an inch wide; the interior ones are oval and somewhat larger. This plant, which commences to flower toward the end of June, sends out but few suckers. It seems to be intermediate between *y. flaccida* and *y. filamentosa*.

Gas Explosion.

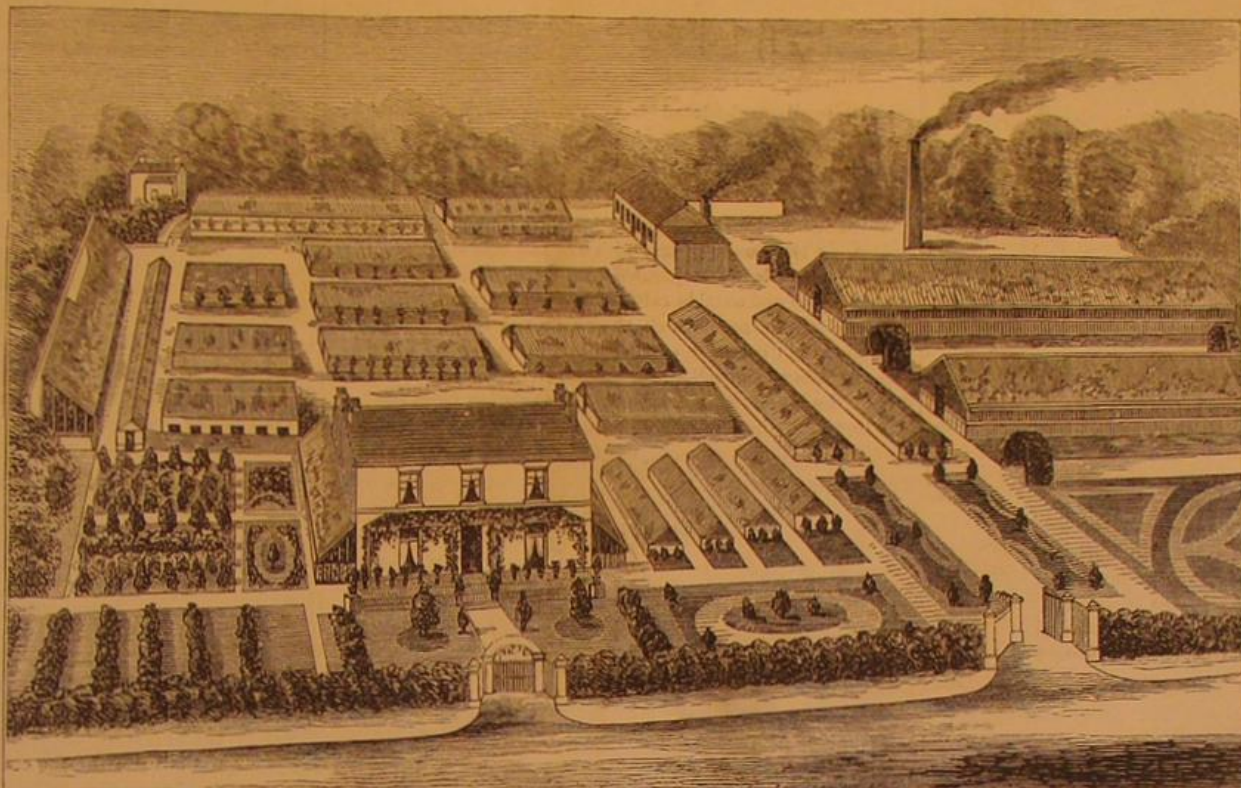
At Hamilton, Ontario, one evening recently, a quantity of gas escaped from the street pipes into a sewer. Some workmen were sent to discover the leak, and the sparks caused by striking stones with their boring tools set fire to the gas, and the flame followed the sewer, causing an explosion about one hundred feet distant. The building under which the explosion took place

received a severe shock, all the glass in the windows being broken, the walls and floors badly cracked, and a man thrown out of his chair.

A New Telegraph System.

A new telegraph system invented by Paul La Cour, Vice-President of the Royal Meteorological Institute at Copenhagen, obtained considerable attention lately at the International Telegraphic Congress at St. Petersburg, where the inventor exhibited it. The invention is thus described by the inventor: "The system does not consist in a new form of receiving and transmitting apparatus, which, by the talented combinations of Hughes, Wheatstone, Siemens, and others, has attained such a state of perfection that great improvements seem improbable. La Cour's system, however, opens up a new scope for telegraphy, in that he has constructed some simple instrument, whereby the electric current, by being passed through a different instrument, obtains different qualities, whereby it can act upon corresponding instruments at the receiving station. Supposing twenty conducting wires be led from one of the poles of a battery through twenty such instruments; then, by connecting each or some of these with a single telegraphic wire, the following result is obtained, namely, that an electric local current is produced in the twenty corresponding conducting wires on the receiving station, exactly as if the twenty conducting wires on the transmitting station were connected with the twenty conducting wires on the receiving station by means of twenty separate telegraphic wires. Each of these instruments contains a tuning fork connected with an electro-magnet and two wire coils, so that the electric current becomes isochronously vibrating in the measures which correspond with the notes of the tuning forks; and thus those tuning forks in them which have the same note as those in the transmitting instruments are set vibrating, and a current is caused in their local wires."

The above system appears to be identical with that of Mr. Elisha Gray, of Chicago, an account of which we published in the *SCIENTIFIC AMERICAN*, August 1, 1874. It was there stated that the invention had been tried with success over a circuit of 2,400 miles on the Western Union Telegraph lines. Details of the *modus operandi* were given, sufficient to enable any skillful electrician to construct an apparatus on the same plan. Now it may be that the Vice-President of the Royal Meteorological Society of Copenhagen did not see the *SCIENTIFIC AMERICAN*, although we have subscribers there, and we believe our paper is on file in some of the libraries of that city; it may be also that he is an independent inventor of the improvement. But unless he can produce proofs of an earlier date of invention than Mr. Gray, M. La Cour should in justice publicly accord to the latter the honors of priority. Electricians will look with interest for M. La Cour's response in this matter.



THE GARSTON VINEYARD, NEAR LIVERPOOL ENGLAND.

only in small gardens, but also in the public squares and parks, for water is not altogether so scarce in towns that a little cannot be spared for the garden, and the labor of applying it is far less, as a rule, in town than in the country. For defying dust, and general hardness of constitution, few plants equal, and none surpass, the hardier species of this genus; but give them the sunny side of the house.

The *yucca stricta* species has long narrow leaves, and a proportionately short stalk to the panicle, the lower part of which does not rise quite clear of the leaves. The marginal threads are very slender and few in number. The lower

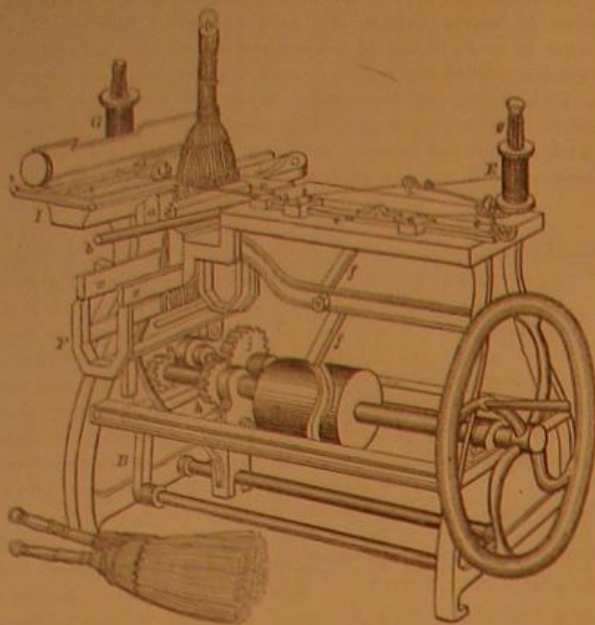


THE YUCCA STRICTA.

MISCELLANEOUS USEFUL INVENTIONS.

Continuing our extracts from Knight's "New Mechanical Dictionary," we give below a variety of engravings, with the necessary descriptions, of several useful and ingenious inventions. Fig. 1 represents a

Fig. 1.

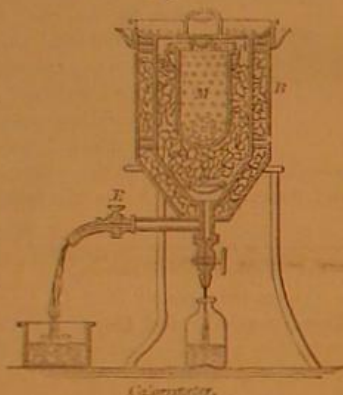


Broom-Sewing Machine.

used for pressing a bunch of broom corn into shape for a broom, and then sewing it in its flattened form. The broom is placed between jaws, *a a*, closed by an eccentric, *c*, and operated by lever, *b*. The machine being set in motion by the rotation of the shaft of the cam wheel, *A*, the cam groove

of the latter, actuating the lever, *f*, forces forward the needle bar, *e*, thus driving the needle with its thread through the broom and above the twine around the latter. The shuttle, *c*, operated by lever, *B*, acting on the opposite side of the

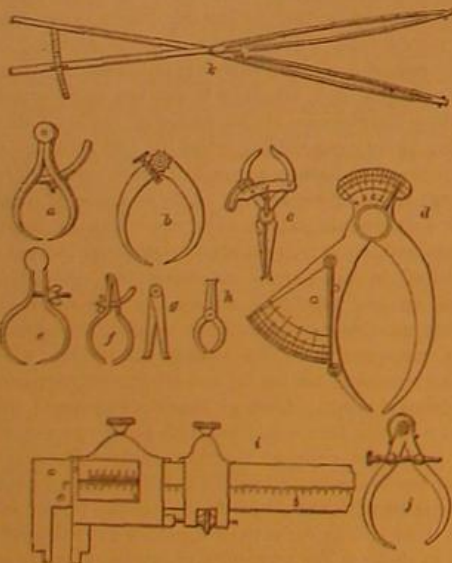
Fig. 2.



Calorimeter.

of the latter, actuating the lever, *f*, forces forward the needle bar, *e*, thus driving the needle with its thread through the broom and above the twine around the latter. The shuttle, *c*, operated by lever, *B*, acting on the opposite side of the

Fig. 3.



Calipers.

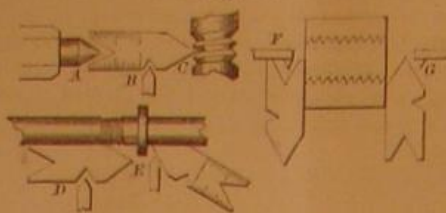
broom in conjunction with the needle, forms the stitch. A reverse movement of the needle bar then withdraws the needle, the eccentric, *n*, lifts the jaws, *a*, so that the next stroke of the needle carries the stitch below the binding twine. The next outward movement of the needle, the jaws being again lowered, carries the stitch above the twine. In this manner the stitches are formed alternately above and below the twine, their distance apart corresponding to the intermittent feed given to the jaws upon their supporting guides, *x*.

THE CALORIMETER.

shown in Fig. 2, is an instrument for measuring the quantity of heat given out by bodies in passing from one temperature to another. The body is weighed, then heated, and finally placed in the compartment, *M*. The lid is placed over it and covered with ice which already fills the surrounding vessel, *A*. Over

this another lid is placed and covered with ice, which the outer vessel, *B*, also contains. Finally, a double lid covers the whole. The ice in *A* is quickly melted, and, flowing out by the stopcock, the water is collected and weighed. The latent heat of water being known, the specific heat of the substance

Fig. 4.



Center-Gages.

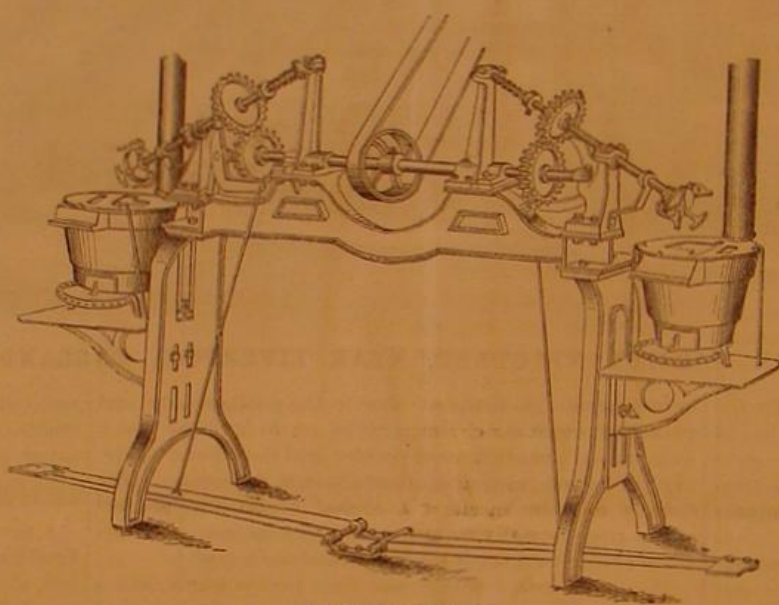
may be readily calculated from the quantity of water obtained.

In Fig. 3 are given several different forms of

CALIPERS

adapted for measuring the diameter of concave or convex bodies. *a* is a bow calipers, with arc and tangent screw; *b* a calipers whose legs are operated by a worm wheel and pinion; *c* is an inside and outside calipers having a graduated arc and index; *d* is a calipers which shows, by the index and arc at the joint, the distension of the points. One leg has a spring, and expands as the calipers is passed over the work, the index on the leg showing the amount of variation from the true size to which the joints have been set; *e* is a spring calipers;

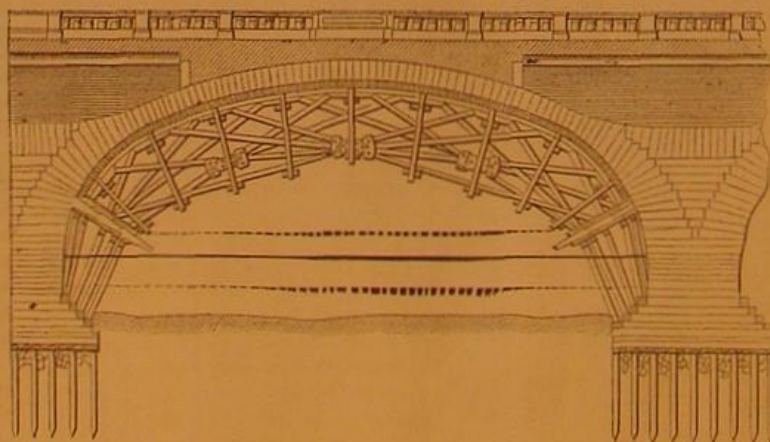
Fig. 5.



Can-Soldering Machine.

f, a common form of calipers with arc; *g*, inside calipers; *h*, inside and outside calipers; *i* is a vernier instrument for inside or outside measurements, which reads to thousands of inches. On the other side are sixty-fourths or fiftieths of inches, to read without a vernier. *j* is a spring calipers with pivoted operating screw and nut, and *k* is a calipers for measuring standing or cut timber, having arms thirteen feet long, and a brass arc on which are figures showing the quar-

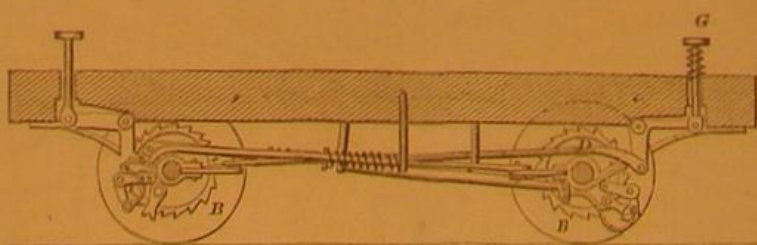
Fig. 6.



Center Waterloo Bridge.

ter girth in feet and inches. Several adaptations of the CENTER GAGE are shown in Fig. 4. The tool is used for showing the angle

Fig. 7.

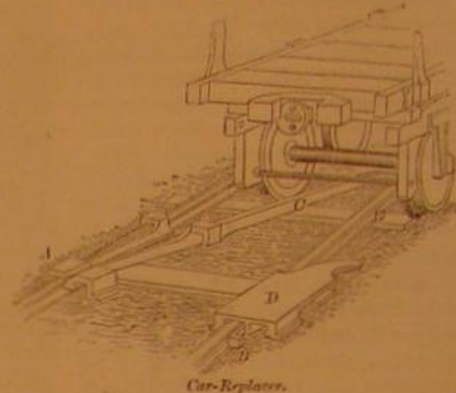


Car-Starters.

to which a lathe center should be turned, and also for accurately grinding and setting screw-cutting tools. At *A* is shown the manner of gaging the angle to which a lathe cen-

ter should be turned, at *B* the angle to which a screw cutting thread should be ground, and at *C* the correctness of the angle of a screw thread already cut. In the lower figure the shaft, with a screw thread, is supposed to be held on the center of a lathe. By applying the gage as shown at *D* or *E* the thread tool can be set at right angles to the shaft, and then fastened in place by the screw in the tool post, thereby avoiding imperfect or leaning threads. In the right hand figure, the manner of setting the tool for cutting inside threads is shown. The angles used in this gage are of 60°

Fig. 8.



Car-Replacers.

The four divisions upon the gage of 14, 20, 24, and 32 parts to the inch, are useful in measuring the number of threads to the inch of taps and screws. Fig. 5 is a

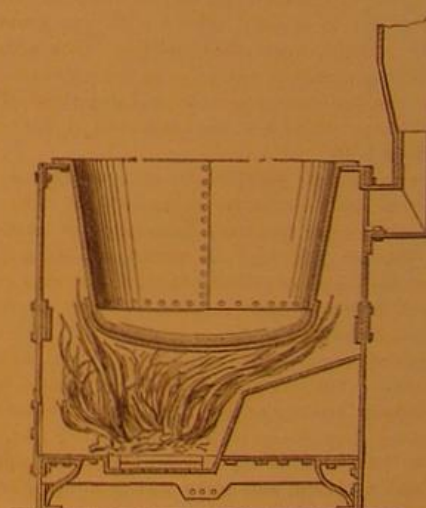
CAN-SOLDERING MACHINE.

In this, a clutch on the end of a shaft, having a bevel wheel gearing with the bevel wheels turned by the central pulley, is placed at each end of a frame, enabling two workmen to operate at once. Beneath each clutch is a bracket for receiving a soldering furnace. A can, with its bottom or top inserted, is fixed upon the clutch, the treadle being previously depressed to throw the bevels out of gear and to withdraw the clutch from the surface of the metal in the soldering furnaces. On releasing the treadle the bevels are thrown into gear, and a spring forces the rod bearing the clutch downward, until the lower edge of the can is slightly immersed in the molten solder, and caused to rotate against the surface of a soldering iron held thereon. After this the treadle is again depressed, and the can removed.

THE CENTERS FOR THE ARCHES OF THE WATERLOO BRIDGE,

in England, have been often cited as admirably arranged structures of their kind. Inclined piles, which carried the weight of the ribs of the center, had their bearings on the offsets of the stone piers, which afforded an excellent abutment. The ribs were laid upon whole timbers capping the piles, and under each set of ribs, wedges were introduced, which were made to extend across the whole width; when it was required to ease the center, the wedges were driven along each other and slid down the inclined plane into larger spaces than they had formerly occupied. The whole center, by this means, was made to descend very gently, and was retained at any required position during the progress of the

Fig. 9.



Asphaltum Furnace.

work. An elevation of the framing is shown in Fig. 6. This center has remarkable strength, and, when struck, the arch settled but a very few inches. The

CAR STARTER,

represented in Fig. 7, is a device intended to assist in starting a street car from a dead stop, so relieving the horses. Pressure on the brake treadle, *G*, causes a frictional contact between the driving wheels, *B*, and the friction wheels, *D*, on the same axle, which retards the motion of the drivers and condenses the spiral spring. When the pressure is removed, the spring actuates a ratchet on the wheel, *B*, thus assisting to gain the initial impulse.

A number of devices have been patented for the purpose of enabling a car to ascend to its position on the rails when drawn or driven by the locomotive. The general feature, in which all varieties of

CAR REPLACERS

agree, is shown in Fig. 8; it consists in two inclined planes, one

forming a bridge, with a plate, D, to let the lower wheel cross the rail and drop into place. The grooved plate, A, forms a bridge up to the other rail. C is a bar to lead the wheel toward the bridge piece.

Asphaltum, or native bitumen, is largely used for pavements, roads, roofs, and as a waterproof cement. For pavements it is mixed with sand or gravel, and laid while hot upon a foundation of broken stones. The

ASPHALTUM FURNACE.

in Fig. 9, is adapted for heating the material which, when melted, is ladled from the boiler and spread upon the surface to be treated. The construction of the apparatus is quite simple, and will be readily understood from the engraving.

Hints in Hygiene.

From the November number of that most excellent journal the *Herald of Health*, we compile the following practical hints for the preservation of health:

CARBONIC OXIDE

is a colorless and almost inodorous gas, containing one part of oxygen less than carbonic acid. It may be seen burning with a beautiful blue flame on the top of a newly fed coal fire. It is much more poisonous than carbonic acid, and must be guarded against with care. It forms abundantly in our coal stoves, and presses through their cracks and joints into our rooms. It escapes from the gas flame when the pressure is so great that more gas flows than can be burned; it forms and escapes from charcoal burning in the open air or in fireplaces, and may escape into sleeping rooms through open stove pipes or broken flues in chimneys, or half burning wood behind the ceiling, in this way greatly injuring those sleeping therein. Even the ordinary smoke that escapes from smoky stoves and fireplaces may contain it, and persons thus breathing it be injured thereby. One of the effects of carbonic oxide on the blood is that its power to take in oxygen is greatly lessened, and the separation of carbonic acid from the blood retarded.

CANDLE-WICK GAS.

The composition of this smoke is carburetted hydrogen, carbonic oxide, burnt olein, etc. When putting out a candle light before going to bed, always do it so that there shall be no burning wick left to poison the air of the room.

BAKED AIR.

When the air is passed through a hot furnace and heated to a high degree, and then passed into a room, such air should be called baked air, and it is about as bad a form of lung food as can be taken. Nothing but headache, faintness, drowsiness, and dullness can come from its use.

HOW HOUSE AIR IS SPOILED.

The following facts will show how the air in houses becomes contaminated:

1. An adult person consumes 34 grammes of oxygen per hour, a gramme being equal to 15 grains.
2. A stearin candle consumes about one half as much.
3. An adult gives off 40 grammes per hour of carbonic acid. A child of 50 lbs. weight gives off as much as an adult of 100 lbs. weight.
4. A schoolroom filled with children will, if not well ventilated at the beginning of the hour, contain 25 parts in 1,000 of carbonic acid, at the end of the first hour 41, and end of the second hour 81.
5. The air is also spoiled by the perspiration of the body, and by the volatile oils given out through the skin. An adult gives off through the skin in 24 hours from 500 to 800 grammes of water mixed with various excrements, poisonous if breathed.
6. A stearin candle gives off per hour 0.4 cubic feet of carbonic acid, and 0.03 lb. of water.
7. Carbonic oxide is a much more dangerous gas than carbonic acid, and this obtains entrance to our rooms in many ways, through the cracks in stoves and defective stove pipes, or when the carbonic acid of the air comes in contact with a very hot stove and is converted into carbonic oxide. The dust of the air may, on a hot stove, be burnt to produce it; or it may flow out from our gas pipes when the gas is not perfectly consumed.
8. Another form of air injury is the dust of a fungus growth which fills the air in damp and warm places. We call it miasm from a want of a true knowledge of its character.
9. Accidental vapors are the crowning source of air poisoning. These are tobacco smoke, kitchen vapors, wash room vapors, and the like.
10. When we heat our houses and close them from outside air, the heat turns the mixture into a vile mess unfit for breathing. The only remedy is ventilation. Now that it is cold weather and our rooms are closed from free currents of outside air, let us look after the matter thoroughly and do our best to prevent injury to ourselves from polluted air.

CURE FOR LOVE OF LIQUOR.

At a festival at a reformatory institution, recently, a gentleman said, of the cure of the use of intoxicating drinks: "I overcame the appetite by a recipe given to me by old Dr. Hatfield, one of those good old physicians who do not have a percentage from a neighboring druggist. The prescription is simply an orange every morning a half hour before breakfast. 'Take that,' said the doctor, 'and you will neither want liquor nor medicine.' I have done so regularly, and find that liquor has become repulsive. The taste of the orange is in the saliva of my tongue, and it would be as well to mix water and oil as rum with my taste."

SMALL SLEEPING ROOMS.

A large sleeping room is but little better than a small one,

unless there is a supply of fresh air for it, and egress for spoiled air; and on the other hand, a small room where there is a constant change of air is nearly as good as a large one.

The supply of air without draft is more important than the size of the room; still a large sleeping room, well ventilated, is most desirable, and children should never be tucked away in small unventilated rooms.

A DRAFT OF AIR.

When the air moves at the rate of two feet in a second, most people will be sensible of a draft, and if the air is cold it will be felt at a less rapid rate. Now a draft is where a current is felt, and in ventilating our rooms in cold weather the air should move through the rooms so as not to be much more rapid than this. In hot weather it may move more rapidly.

SIZE OF SCHOOL ROOM.

For a school room for 20 pupils, 36 feet square and 12 feet high is about the right size. The entire air of such a room should be warmed and changed five times an hour to keep the carbonic acid down to the proper amount; nothing short of this will keep the air sufficiently sweet. At the end of every hour the room should be flushed from every direction to still further purify it.

COUNTERFEIT GRAHAM FLOUR.

Nearly all the Graham flour sold in New York, and perhaps in other large cities, is bogus. It is made by mixing the coarsest of the bran with either spoiled flour or with white flour which may not be spoiled. This flour is made into bread by bakers and sold to dyspeptics who think it wholesome, but it is a poor substitute for the genuine article. Those who want a genuine article must either make it with a home mill, or have it made to order by an honest miller.

TREATMENT OF SORE THROAT.

In cases of ordinary sore throat, the simplest and best treatment is the wet pack, using a linen cloth wrung from cold water, and over this a knit or crocheted yard band, four feet long and four inches wide. Apply this two or three nights in succession, unless it is a very serious case, when the pack should be kept on during the day. If taken off in the morning, wash the throat in very cold water, and rub dry with a coarse towel and with the hand. This will prevent taking more cold. The more friction used the better; let it be a sort of squeezing of the parts so as to affect the deep-seated tissues. Sore throats may be prevented by these means from becoming chronic.

SCHOOL ROOM DEFORMITIES.

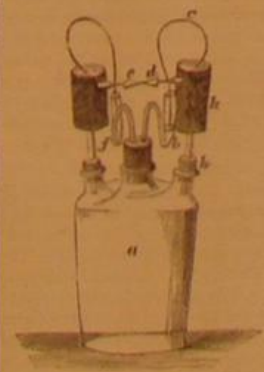
The bodies of growing children are soft and tender, easily made to grow in either a normal or abnormal shape. Now to grow normally requires constant change of position and freedom of limb. It also requires exercise to make the blood flow and load it with fresh air. Now confinement in a school room, unless strict attention is given to air and exercise, prevents their free development and causes deformity. The only remedy is to make physical culture as prominent as mental, a thing not yet done by any means in even the best schools.

PROFESSOR BUNSEN'S NEW APPARATUS AND BATTERY FOR SPARK SPECTRA.

Only for a small number of elements and their compounds is the relatively low temperature of the non-luminous gas flame sufficient to produce spectra which can be of use in analytical researches; by far the larger number turn into vapor at such degrees of temperature as can be obtained only by the electric spark. There are difficulties, however, in the way of employing spark spectra, which consist in, first, the necessity of a simple method by which such spectra can at any time be produced; and second, the absence of spectrum tables useful for all practical purposes.

Professor Bunsen has recently devised means for the overcoming of these drawbacks; and in a very important treatise, the first portion of which, relating to the first requirement above noted, has just been published, he fully describes the results of his investigations. An abstract of the treatise we find in *Nature*, from which the following facts and the annexed illustration are taken.

Professor Bunsen has invented a new battery and a new spark apparatus, by which the spark spectra can at any time be obtained with the same ease and facility as ordinary flame spectra. The battery is a charcoal-zinc battery without clay cells. The exciting liquid is a mixture of bichromate of potash and sulphuric acid. To prepare the liquid, 1.6 lbs. of powdered bichromate are mixed with 0.881 quart of sulphuric acid in a stone jar, while the mass is constantly stirred; when the salt is changed to sulphate of potash and chromic acid, 0.75 quarts of water are added, the stirring being kept up and the water allowed to flow from a spout about $\frac{1}{4}$ inch wide; the crystal meal, which already is very warm, eventually dissolves completely. The exciters of the liquid are a rod of the densest gas coal, 1.56 inches broad, 5 inches thick, and immersed 4.6 inches into the liquid, and a rolled plate of zinc of the same breadth, of a thickness of 0.19 inch, and immersed to a like depth. The zinc is coated with a layer of wax applied hot, except on the side turned toward the



coal, which is amalgamated. The distance between coal and zinc is optional. The best shape for the cells is that of narrow high cylinders. This battery possesses an electromotive force which is about 13 per cent larger than the ordinary charcoal-zinc or Grove battery. Its essential conduction resistance is about 12 per cent smaller than that of Grove's battery with clay cells.

Four of the pairs above described are used for the production of spark spectra. The pole wires conduct the primary current, of which a branch puts the current interrupter into action, to a Ruhmkorff apparatus, the induction coil of which has a diameter of nearly 7.8 inches and a length of 19.5 inches. The induced current is carried to the spark apparatus represented in the illustration, which is placed in front of the slit of the spectroscopic. The bottle with three necks, a, serves merely as a stand. The current passes from the mercury cup, b, through the fine wire, c, to the carbon point, d, which is fastened on a pointed platinum wire; thence, it passes as a spark to the other carbon point, e, and from this it reaches the second mercury cup, f, which is connected with the other end of the induction coil. The platinum wires, which are surrounded by glass tubes sealed firmly upon them, can be moved upwards or downwards by the corks, h, and this allows of a quick and exact fixing of the carbon points before the slit of the spectroscopic.

The method given of preparing the charcoal for the points consists in heating sticks of the coal to an intense white heat in a covered porcelain crucible, contained in a large clay crucible and surrounded on all sides by powdered charcoal. The slides are afterwards cut into cones, and then, in order to eliminate the potash, soda, silica, etc., contained in them, they are boiled in a platinum dish, first with hydrofluoric acid, then with concentrated sulphuric acid, then with concentrated nitric acid, and finally with hydrochloric acid, repeating each process several times, while between each manipulation each of the acids is removed by washing and boiling in water. The carbon cones, after this treatment, weigh about 0.2 grain each, and can absorb more than their own weight of liquid. They give a spark spectrum of very long duration.

Scouring Liquid.

For a considerable time Panama wood and Panama extract have been in great use in France. The following is the recipe given by M. Leclerc for what he calls the *esprit de Panama*, for scouring and removing grease from tissues of all kinds and worn clothes. To take out spots the liquid is used pure, but for general scouring it is mixed with four or five times its own quantity of water.

In 22 gallons of hot water dissolve white Marseilles soap 15½ lbs., and carbonate of potash 1.3 lbs. or 15 or 18 lbs. of soft soap. To the solution add extract of Panama 1.1 lbs.; then in another vessel mix ox or sheep gall 15 quarts, and ammonia at 22°, 3 pints. Heat this mixture, skim it, let it cool, and then add alcohol at 90°, 3.3 gallons; decant and filter.

Take one third part of the soap mixture and two third parts of the gall mixture, and add some aromatic essence.

Method of Increasing the Brilliance and Silkiness of Dyed Goods.

MM. Gillet et Fils, of Belgium, have adopted, and apparently patented, a simple process for this purpose. In addition to the beating by hand or by mechanical power of the dyed silk when in a wet state, they beat it again when dyed and dry, and say that the effect is surprising. They use the same means as in the former case, hand power, the Dashwell machine, beaters, or even fulling mills. The method is said to be equally effective for silk and any other textile material whatever.

New Vehicle for Colors.

A new method of preparing colors for printing on tissues paper, leather, or any other substance which will take color, is the invention of M. J. P. Daguzan, a Belgian. It consists of a base of natural caoutchouc or, in certain cases, of gutta percha or other gums. The gum is reduced in benzine or other solvent to the consistence of thin paste, and organic colors are added as desired. In practice, down or the shearings of wool or silk, previously dyed of the desired tint, are used, but they may be replaced by any other analogous substances.

Instantaneous Bleaching Fluid.

In 5½ pints of water, heated to 190 or 212° Fahr. are introduced successively: Mother of pearl, 3½ ozs.; indigo, 0.75 grain; cochineal, 0.75 grain; chloride of lime, 150 grains; soda crystals, 150 grains; potash, 150 grains. Boil for half an hour, and the preparation is ready for use. The inventor, M. Boiseller, says: "The mother of pearl gives softness, luster, suppleness, etc., and gives to hemp the feel of cashmere; the indigo gives a slight azure tint, the cochineal adds brightness, the chloride effects the bleaching, the soda washes and brushes, and the potash removes all grease."

PROFESSOR F. E. NIPHER suggests the following optical experiment: Observe a white cloud through a plate of red glass with one, and through green glass with the other eye. After some moments transfer both eyes to the red glass, opening and closing each eye alternately. The strengthening of the red color in the eye, fatigued by its complementary green, is very striking.

THOUGH Howe is no more, the Howe Sewing Machine Company is still prospering. A few years ago it established a branch in Scotland, with Glasgow as its headquarters, and it may surprise our readers to learn that in the company's works in the city named 800 persons are employed, and 1,500 machines manufactured weekly.

Freezing Mixtures.

One of the most familiar is the common freezing mixture, which generally consists of equal parts of pounded ice or snow and salt, which produces a reduction of temperature to about -16° C. (3° F.), and is often used for making ice creams, etc. If, instead of the salt, we used three parts of crystallized chloride of calcium at 0° (32° F.), and two parts of snow, we obtain a far more powerful freezing mixture, the temperature falling to about -45° (-49° F.), and quite sufficient to freeze mercury. The salt in the first instance melts the ice, the water thus formed in its turn melts the salt; so we have both the solids changing to the liquid state simultaneously, consequently absorbing a large amount of heat. For a similar reason, the solution of most salts in water is accompanied by the absorption of a large amount of heat; nitrate of potash and chloride of potassium both cool the water in which they are dissolved.

A useful machine is now made for freezing water without the use of ice, which cannot always be obtained, by mixing together powdered sulphate of soda and common hydrochloric acid. The apparatus consists of an upper and lower thin metal chamber, the upper one having two inner casings and an interior revolving inner cylinder, capable of being turned by a handle at the top. The freezing mixture is placed in the inner casing, and the water to be frozen in the outer casing and in the revolving cylinder. Several vanes are fixed on the outside of the cylinder, so that, when it is turned by the handle, the acid and sulphate are kept constantly mixed. After sufficient ice has been made, the water is drawn off into the lower chamber, which is prepared for holding a number of bottles of wine to be cooled by this liquid.

Detection of Arsenic in the Air of Rooms.

H. Fleck has shown in a series of interesting and important experiments that there is arseniuretted hydrogen in the air of rooms, the walls or the carpets of which are colored with Schweinfurth green. The dust of arsenic mechanically diffused in the air is therefore not the only cause of chronic arsenical poisoning. We must add the arseniuretted hydrogen gas evolved from the decomposition of the free arsenious acid existing in the green. The experiments of Fleck prove that this gas is liberated under the joint action of organic matter and moist air, and its presence is therefore possible wherever free arsenious acid comes in contact with organic matter.—*Zeitschrift für Biologie*.

THE angular velocity of clouds is determined by M. Hurst de Villeneuve in the following way: He takes a ball of silvered glass, on which he draws with ink an equator and equidistant meridians. He places the sphere so that, the axis being horizontal, the cloud may be seen, by reflection, displaced along the equator traced, and then the time which it takes to go from one meridian to the next gives the angular velocity.

Recent American and Foreign Patents.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED HATCHWAY BRACE.

James Fleming, Buffalo, N. Y.—This invention consists of adjustable braces which strengthen the sheave timbers, through which the rope attached to the grain shovels pass. The braces also serve to hold the elevator in position, and to protect the shovel ropes against chafing.

IMPROVED HANGER FOR SLIDING DOORS.

Leeds A. Cook, Danville, N. Y.—This is an improvement on the invention patented to same inventor November 1, 1870. The object is to simplify that device, and the arrangement is so modified as to consist of a sliding door hung to a swinging lever sliding in a slot of the main post, and supported centrally by a radius bar pivoted to said post, so as to be opened and closed by a parallel motion.

IMPROVED SLEIGH.

Benjamin F. Sweet, Fond du Lac, Wis.—The knee of the sleigh is so constructed that it has considerable play or movement in the socket formed by the parts by which it is secured to the runner. The runners are hence adapted to yield somewhat to uneven surfaces, so that the bob will sustain heavy loads, and will glide over the snow with less friction than those whose frame is rigid.

NEW HOUSEHOLD ARTICLES.

IMPROVED WOOD SPLITTER.

William Latus, Brooklyn, assignor to T. Karutz, Brooklyn, E. D., N. Y.—This is a portable contrivance for splitting wood for lighting fires without damaging the hearth, or using a hatchet. There is a bed piece supporting a horizontal blade, which is caused to reciprocate by means of a handle connected to it by rack and pinion. The wood, being placed between the blade and stationary bed, is quickly split.

IMPROVED CLOTHES DRYER.

Lorin A. Walt, Riceford, Minn.—The arms on which the clothes are hung are attached to a collar which slides on a vertical post. They pass through slots in a revolving cap on top of the post, so that, when the collar is pushed up toward said cap, the arms extend radially, and when the collar is lowered they fold in compactly. By this arrangement, the device can be stowed away in a small space when not in use.

IMPROVED KEY FASTENER.

William W. White, New York city.—This is a useful little invention for travelers, inasmuch as it prevents the key of a door being turned by nippers or other instrument inserted in the keyhole from the outside. A bow of metal in form of a staple hangs on the knob shaft, and passes through the key loop; and its ends are secured in a small block by means of a set screw.

IMPROVED NON-EXPLOSIVE LAMP.

George W. Vernon, Bonacks, Va.—The invention consists in a wick tube enlarged toward its upper end and provided with a divided neck, to form a channel discharging at the top of the tube. This is applied to a lamp having an oil reservoir below and a water chamber above, the wick tube passing down through the latter to the former. By this construction, the wick tube is kept cool while, in case of an overturn, the flame is instantly extinguished.

IMPROVED BEEF STEAK TENDERER.

Theophilus Billington, Weatherford, Tex.—This inventor proposes to pass the steak through studded rollers, mounted one above another on a stand. Said rollers may be adjusted for different thicknesses of meat, and may be pressed together by power easily regulated by the operator.

NEW AGRICULTURAL INVENTIONS.

IMPROVED GRAIN SEPARATOR.

Hermann Mielke, Watertown, Wis.—This machine is so constructed that the current created by the fan acts on the grain in its passage from the hopper, and separates the light grain from the heavier. The lighter falls on a laterally inclined plane, between partitions, and is conveyed to the side of the mill, the chaff and other impurities being conveyed over an outer inclined plane, extending downward from the second partition wall. The machine may be worked for any kind of grain by a simple regulation of the feed opening and current.

IMPROVED HARVESTER.

Christopher Lidren, La Fayette, Ind., assignor to himself and R. Jackson, of same place.—In this invention, the novel features include a rake pivoted to the rake standard to swing backward and forward to discharge the gavel, together with devices which turn the rake or scraper up edgewise preparatory to going back to scrape off the gavel, and turn it down flatwise preparatory to going forward again. Arrangements are provided to pass the scraper forward below the platform and up through it and the grain which falls while a gavel is being discharged. There is also a means of returning the rake to the front without interfering with the grain lying on the platform, and a novel mode of supporting and adjusting levers for the reel, whereby it can be readily raised and lowered by the driver without moving from his seat, and without altering the tension of the belt.

IMPROVED MOWING MACHINE.

David Wolf, Avon, Pa.—This inventor proposes ingenious mechanism for locking the cutter bar of a reaper or mower in different positions to adapt it for various kinds of work, and to enable it to be fastened upright for passing from place to place.

NEW CHEMICAL AND MISCELLANEOUS INVENTIONS.

IMPROVED SAFETY OIL RESERVOIR.

Thomas Scantlin, Evansville, Ind.—This consists of a can or reservoir provided with a pump and with measuring compartments and a filling compartment and tube. The measuring vessels may be of different size, so as to hold the quantities usually called for, as one quart, two quarts, or a gallon. The oil is drawn, as it may be ordered, directly into the customers' vessels, and is not exposed to the air, or to danger from fire.

IMPROVED VARIABLE MEASURE.

Charles P. Sullivan, Jr., Line Creek, S. C.—This inventor has devised an ingenious method of combining several measuring vessels in one. The box has a movable bottom which is shifted up or down in the interior and sustained by pivoted pieces from below, and by pins inserted through perforated hollow vertical tubes on the sides.

IMPROVED BUTTON FASTENING

James H. Harrington, Providence, R. I.—This is a new way of fastening buttons to garments so that they may be attached or detached without sewing. The button has a spring hook eye pivoted its back in which is inserted a ring.

IMPROVED MEDICAL COMPOUND.

John W. Harvey, Memphis, Mo.—This invention relates to a new medical compound for the cure of catarrh. It is composed of nitrate of potash, chlorate of potash, powdered golden seal, table salt, and gum camphor, to be dissolved in water and used as a bath to the head and nose, or snuffed up the nose and inhaled in the form of a powder.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED COMPRESSION COCK.

James McLaughlin, New York city.—This compression cock is so constructed that it may be fully opened and closed by a half turn of the handle. The inventor states that it is entirely free from leakage, durable when used with both hot and cold water, and not liable to get out of order.

IMPROVED LUBRICATOR.

Joseph Warren Reed, Kalamazoo, Mich.—This is a hollow plug charged from the holder and discharged into the engine, at the same time cutting off the supply from the holder. The new features include, first, an improved contrivance of venting the hollow plug, by which there is no waste; second, of a valve to shut off steam from the holder to prevent the mixing of water with the oil by the condensation of steam; third, of a vent or waste pipe connecting with the space above the valve, to carry off the condensed steam in case the valve is not perfectly tight, and insure its closing; and, fourth, of a contrivance to regulate the amount of oil delivered.

IMPROVED ROAD ENGINE.

John Henry Bange, Edwardsville, Ill.—This is a new and ingenious form of road engine, to which the name of the "Mountain Runner" has been given by its inventor. Many of the improvements are of a mechanical nature and cannot be clearly described without the aid of drawings. The principal feature, however, consists in the novel construction by which the water in each compartment, when the engine is passing up and down hill, finds its level independent of the water in the other compartments of the boiler, so that it cannot collect at the end of the boiler, but will be distributed through it.

IMPROVED DEVICE FOR TRANSMITTING POWER.

John Wesley Woodruff, Jollytown, Pa.—This invention consists of the connection of a fly wheel by a long crank lever, of which one end is fixed to a point near the circumference of the fly wheel, while the other crank-shaped end turns a large spur wheel that intermeshes with a pinion of a shorter shaft with a transmitting pulley. The transmitting lever turns by a ball journal in socket bearings near the crank end. This enables the power of an engine to be transmitted for some distance and then applied directly to machinery.

IMPROVED CAR WHEEL CHILL.

William Wilmington, Toledo, Ohio.—This invention relates to certain improvements in chills for casting car wheels, and it consists in constructing the metallic annular chill with annular air chambers at the points of the interior surface of the chill where the outer periphery of the flange of the wheel is formed, and also at the points where the outer horizontal surface of the tread is formed, by means of which the central portion of the tread which receives the greatest wear is allowed to harden; but the outer periphery of the flange and the outer surface of the tread are prevented from rapid cooling by the new conducting air chamber, and the metal at these points is molded and preserved in its full strength and tenacity, a result to be greatly desired in view of the fact that, while the process of chilling hardens the iron, it greatly impairs its tenacity and strength.

IMPROVED ELEVATED RAILWAY.

John Westcott, Tocol, Fla.—The object of this invention is to provide a cheaper construction of railroads and cars than that now in use, and it consists in a single iron rail laid upon and fastened to a continuous beam of wood, which is supported upon the ends of a series of piles driven into the earth so as to constitute an elevated railway. The cars have a single set of wheels, which have two flanges and run upon the rail, the bottom of the car being close to the rail, and the sides of the same extending down by the sides of the piles and engaging with friction rollers upon the same to steady and hold the car in position.

IMPROVED CAR COUPLING.

Hugh F. McKervey, Cheboygan, Mich.—This invention is an improvement in car couplings of the harpoon variety, and it relates, first, to the combination and arrangement whereby the coupling bar is connected with a pivoted counterweight, and by it maintained in such position that lateral arms or shoulders formed on its middle portion will remain engaged with hooks or shoulders formed on the front end of the same drawhead which contains the counterweight. The invention consists, secondly, in the arrangement of a sliding bar in such relation to the counterweight, pivoted within the chamber of the drawhead, that the latter may be thereby raised, or turned on its pivots, and locked, or held in its elevated position by the slide bar projection under it.

IMPROVED DRIVE-WELL PACKING.

Vincent F. Thomacich, Mobile, Ala.—This invention relates to the packing of the drive well or other pumps, and contemplates a prevention of the curling of the hard leather packing. It consists in a metallic ring support, concaved on the inside and bracing the leather packing of the piston.

IMPROVED SPINDLE BOLSTER.

Welcome Jenckes, Manchester, N. H.—This invention relates to what is known as the spindle bolster of spinning frames, and consists of a longitudinal slot in the bolster, in which slot is placed a packing, which is saturated with oil for lubricating the spindle. By this arrangement, the spindle is kept lubricated for weeks continuously, and the trouble of oiling every day, as is usually the case, is obviated.

IMPROVED COTTON PRESS.

Benjamin F. Platt, Vienna, La.—This is a very simple and inexpensive plan for applying hand or horse power to work the press. The press case is arranged on stationary pivots. Each pivot is screw-threaded, and has for its head one of the press followers. The screws are right and left handed, so that they move the followers in opposite directions at the same time, when the power is suitably applied.

IMPROVED LIFTING JACK.

Samuel E. Mosher, Chillicothe, Ohio.—In this device the lifting bar has downwardly-inclined teeth on one side in which teeth on the lifting dog engage. The dog is pivoted to a lever, which in turn is pivoted to swinging bars on top of the stand, so that the dog is drawn into the teeth on the bar when force is applied to the lever.

IMPROVED ADJUSTING FEED ROLLS FOR PLANING MACHINES.

Charles D. Lawrence and Charles E. Ward, Fairfield, Me.—The feed rolls are mounted on a rod by bearings which can slide or be fixed in position as may be preferred. The bearings are moved by a shaft having pinions gearing with station racks. An arm connecting the lower sliding bearing turns it to shift a pinion along the feed roll to keep it in gear.

IMPROVED ADJUSTABLE BUMPER OR FENDER PLATE FOR PILES OF ELEVATED RAILWAYS.

John Westcott, Tocol, Fla.—The object of this invention is to provide a bumper or fender plate for protecting the piles of elevated railways, in which the track consists of a single rail mounted upon a series of piles, and the car is provided with pendent extensions upon each side of the rail which extend down beside the piles. The invention consists in two symmetrically shaped curved plates faced upon the inside with elastic cushions and provided with flanges which are fastened together by means of screw bolts, so as to cause the said plates to tightly clamp the piles, and having lugs to keep them from turning.

NEW BOOKS AND PUBLICATIONS.

THE HUMAN VOICE, ITS ANATOMY, PHYSIOLOGY, PATHOLOGY, THERAPEUTICS, AND TRAINING. By R. T. Trall, M.D., Principal of the Hygeio-Therapeutic College, etc. New York city: S. R. Wells & Co., 735 Broadway.

This work is intended to be a manual for the use of students of elocution, and to it are appended rules for the management of debating societies, and some selections from popular authors for practice in reading aloud with correct and appropriate expression.

MANUAL FOR THE USE OF THE GLOBES. Illustrated. By Joseph Schedler. New York city: E. Steiger, 22 and 24 Frankfort street.

This is a very readable little pamphlet, containing some excellent remarks on the value and importance of the science of geography. The astronomical information is very concisely and well expressed.

HANDBOOK FOR CHARCOAL BURNERS. By G. Svedelius. Translated from the Swedish by R. B. Anderson, A.M. Edited, with notes, by W. J. L. Nicodemus, A.M., C.E. Illustrated. Price \$1.50. New York: John Wiley & Son, 15 Astor Place.

This little manual was originally prepared for the Government of Sweden, chiefly from two meritorious but unsuccessful papers offered in response to an official call for a popular treatise on charcoal burning. It no doubt fairly represents the best practice of Sweden in the matter of charcoal making, and may be found useful to those engaged in pit burning on a small scale. Professor Nicodemus has added a few notes from Percy's "Metallurgy," and from Crookes & Eshrig's treatise on "Fuel," the latter describing briefly some of the older methods of kiln-burning practised in this country. To answer for American charcoal makers, this portion of the work would need to be very much extended.

A TREATISE ON THE RICHARDS STEAM ENGINE INDICATOR, AND THE Development and Application of Force in the Steam Engine. By Charles T. Porter. New York city: D. Van Nostrand, 23 Murray and 27 Warren streets.

This work is written in a clear, lucid style, showing its author to be thorough master of his subject. The reader is led, from a clear understanding of the requirements of an indicator and the manner in which the well known Richards indicator fulfils them, to carefully written instructions, first as to how to use the instrument, and then how to compute the results of any given diagram. The laws governing the development and application of force in a steam engine are laid down in a concise manner, giving a complete understanding of their principles. The book contains many excellent and carefully compiled tables, showing an immense amount of work by the author, and will be found useful to the professional engineer as well as the student.

Inventions Patented in England by Americans.

(Compiled from the Commissioners of Patents' Journal.)

From October 8 to October 12, 1875, inclusive.

CONDENSER.—Hansome Siphon Condenser Co., Buffalo, N. Y.

DOUBLING MACHINE, ETC.—J. F. Wicks, Providence, R. I.

EXCAVATING MACHINE.—P. J. Snyker, New Brunswick, N. J.

LIGHTING GAS, ETC.—M. E. Jones, Pittsfield, Mass.

STILT.—F. Beaumont, Jr., et al., Dallas, Texas.

Business and Personal.

The Charge for Insertion under this head is One Dollar a Line. If the Notices exceed Four Lines, One Dollar and a Half per Line will be charged.

Dry steam dries green lumber in 2 days, and is the only Cheap House Furnace. H. G. Bulkley, Cleveland, O.

For Sale—Machine Tools, 2d Hand, good order: Planer, 12 ft. x 26 in. x 32 in., \$800; Crank Planer, 2 ft. bed, 14 in. stroke, \$345; Upright Spiner, 5 in. stroke, \$90; New Milling Machine, platen 15x3, \$387; Putnam 24 in. Gear Cutter, \$500; Upright Drill, 32 in. swing, \$325; ditto, 56 in. swing, \$250; Engine Lathes, as follows: 1—new 25½ ft. bed, 36 in. swing, \$1,550; 16 ft. x 31 in. swing, \$600; 15½ ft. x 30 in. swing, \$630; 12½ ft. x 30 in. swing, \$500; 16 ft. x 24 in., \$240; 12 ft. x 24 in., \$175; 9 ft. x 15 in., \$240; 6 ft. x 15 in., \$230; 8 ft. x 17 in., \$215; Double-headed 15 ft. x 20 in., 11 ft. x 12 in., and 16 ft. x 20 in., \$250, \$155, and \$250, respectively; 8 ft. x 20 in., \$200; 5 ft. x 14 in., \$195; 5 ft. x 15 in., \$210; 8 ft. x 17 in., \$240; 6 ft. x 17 in., \$225; 4 ft. x 9 in., \$140. Also speed or drill lathes, as follows, viz: 5 new ft. x 12 in., each \$75; 6 ft. x 15 in., \$50; 2 ft. x 9 in., \$35; 3 ft. x 8 in., \$30; 5 ft. x 18 in., \$75; 6 ft. x 14 in., \$50. Also new "Onella" make of Chucks, 3 in., \$100; 15 in., \$50, and 12 in., \$42; No. 4 Wiley & Russell Power Bolt Cutter, \$170; 7 ft. holze Iron Frame Trip Hammer, \$150; Japanning Oven, \$20. For full printed lists, address Forsaith & Co., Manchester, N. H.

For Sale—Miscellaneous Machinery, 2d Hand Horse Power, with wood sawing rig, \$165; Hydraulic Presses and Pumps, weighing 15,000 lbs., \$650; No. 4 Blake Pump, \$220; No. 1 Seldon Pump, \$80; No. 2 Knowles Pump, \$85; 5 ft. Whitney Water Wheel, complete, \$400; 5 ft. Blake Wheel, complete, \$375; 3 ft. Whitney Wheel, \$275; Lot ¼ in. iron chain, 4½ cts. per lb.; No. 7 Starvant Blower, 4 ft. diam., with Steam Boiler for drying wool by heated air, almost new, cost \$1,100, price \$450. Iron Pulleys as follows, finished: 12 ft. x 25 in., 4c. lb.; 9 ft. x 20 in., 5c. lb.; 6½ ft. x 30 in., 4½ cts. per lb.; 5 ft. x 25 in., 3½ cts. lb.; 5 ft. x 12 in., 5c. lb.; 4 ft. x 10½ in., 5c. lb.; 4 ft. x 19 in., 4½ cts. lb.; 42 in. x 22½ in., 5c. lb.; 3 Binder Rolls with shafts and boxes, 2x2x2 in., \$18; 25x21 in., \$18; 22x19 in., \$8. For printed lists, address Forsaith & Co., Manchester, N. H.

The largest newspaper mail which goes to any one firm in this country, is received by Geo. P. Rowell & Co., the New York Advertising Agents. Their place of business is at No. 41 Park Row. [Exchange.]

25 per cent extra power or saving in fuel, guaranteed to steam engines, by applying the R. S. Condenser. T. Sault, Consulting Eng'r, Gen. Agt., New Haven, Ct.

Solid Emery Vulcanite Wheels—The Original Solid 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, New York.

Wanted—A First Class Tinner. One accustomed to small work, such as Saddlery Hardware, preferred. Address Factor, Philadelphia, P. O.

Parties wanting articles made, wholesale, on wood-working machinery, call on or address C. E. Phillips, Vandalia, Ill.

Capitalists or Manufacturers Wanted—To take interest in the manufacturing of Toepperwein's new Repeating Guns, Address E. A. F. Toepperwein, Boerne, Kendall Co., Texas.

Gothic Furnace, for coal and wood, heats houses churches. Send for book. A. M. Lesley, 236 W. 23d St., N. Y.

Traction Engines, good order, for Sale cheap—International Chemical Works, 10th St., Hunter's Point, N. Y. Double-Entry Book-Keeping Simplified. The most successful Book on the subject ever published. Cloth, \$1. Boards, 75 cts. sent post paid. Catalogue free. D. B. Waggner & Co., 424 Walnut St., Philadelphia, Pa.

Bolt Headers, both power and foot, and Power Hammers, a specialty. S. C. Forsaith & Co., Manchester, N. H.

Main Driving Belts—Pat'd improvement. Address for circular, Alexander Bro's, 412 N. 3d, Philadelphia, Pa.

Boul's Paneling, Moulding and Dovetailing Machine is a complete success. Send for pamphlet and sample of work. B. C. Mach'y Co., Battle Creek, Mich.

For best and cheapest Surface Planers an Universal Wood Workers, address Bentei, Margedar & Co., H. Milton, Ohio.

Patent Scroll and Hand Saws, best and cheapest use. Cordesman, Egan & Co., Cincinnati, Ohio.

Small Engines. N. Twiss, New Haven, Conn.

The Original Skinner Portable Engine (Improved), 2 to 5 H.P. L. G. Skinner, Erie, Pa.

Camp Lounge, \$5. C. L. Co., Troy, N. Y., and Newark, Ct. N. Y. City Salesroom, 171 Broadway.

Hotchkiss Air Spring Forge Hammer, best in the market. Prices low. D. Frisbie & Co., New Haven, Ct.

Saw Teeth Indicator—Showing improved form for filing teeth on saws for use in different kinds of wood, &c. Sent free for 50c. E. Roth, New Oxford, Pa.

For reduced prices of Surface Planers and Mitre Dovetailer's Machines, send to A. Davis, Lowell, Mass.

"Pantect," or Universal Worker—Best combination of Lathe, Drill, Circular, and Scroll Saw. E. O. Chase, 7 Alling Street, Newark, N. J.

To Manufacturers—Pure Lubricating Oil, Sample Package (24 gals.), \$7. Send to Geo. Allen, Franklin, Pa.

Educational Lantern Slides—Send for Catalogue to Prof. W. A. Anthony, Cornell University, Ithaca, N. Y.

Hotchkiss & Ball, Meriden, Conn., Foundrymen and workers of sheet metal. Fine Gray Iron Castings to order. Job work solicited.

For Sale—Second Hand Wood Working Machinery. D. J. Lattimore, 31st & Chestnut St., Phila., Pa.

Price only \$3.50.—The Tom Thumb Electric Telegraph. A compact working Telegraph Apparatus, for sending messages, making magnets, the electric light, giving alarms, and various other purposes. Can be put in operation by any lad. Includes battery, key, and wires. Neatly packed and sent to all parts of the world on receipt of price. F. C. Beach & Co., 246 Canal St., New York.

Small Tools and Gear Wheels for Models. List res. Goodnow & Wightman, 28 Cornhill, Boston, Mass.

Peck's Patent Drop Press. Still the best in use. Address also Peck, New Haven, Conn.

For Solid Emery Wheels and Machinery, send to the Union Stone Co., Boston, Mass., for circular.

All Fruit-can Tools, Ferracute Wks., Bridgeton, N. J.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Baffing Metals. E. Lyon, 470 Grand Street, New York.

Brass Gear Wheels, for Models, &c., on hand and made to order, by D. Gilbert & Son, 212 Chester St., Philadelphia, Pa. (List free.) Light manufacturing solicited.

American Metalline Co., 61 Warren St., N. Y. City.

Genuine Concord Axes—Brown, Fisherville, N. H.

Faught's Patent Round Braided Belting—The Best thing out—Manufactured only by C. W. Army, 148 North 3d St., Philadelphia, Pa. Send for Circular.

For 13, 15, 16 and 18 inch Swing Engine Lathes, address Star Tool Co., Providence, R. I.

Diamond Tools—J. Dickinson, 64 Nassau St., N. Y.

Magic Lanterns and Stereopticons of all sizes and prices. Views illustrating every subject for Parlor Amusement and Public Exhibitions. Pays well on small investments. 72 Page Catalogue free. McAllister 49 Nassau St., New York.

Temples and Oilcans. Draper, Hopedale, Mass.

Water, Gas, and Steam Goods—New Catalogue packed with first order of goods, or mailed on receipt of eight stamps. Bailey, Farrell & Co., Pittsburgh, Pa.

The "Scientific American" Office, New York, is fitted with the Miniature Electric Telegraph. By touching little buttons on the desks of the managers, signals are sent to persons in the various departments of the establishment. Cheap and effective. Splendid for shops, offices, dwellings. Works for any distance. Price \$4, with good Battery. F. C. Beach & Co., 246 Canal St., New York. Makers. Send for free illustrated Catalogue.

For best Bolt Cutter, at greatly reduced prices, address H. B. Brown & Co., New Haven, Conn.

The Baxter Engine—A 48 Page Pamphlet, containing detail drawings of all parts and full particulars, now ready, and will be mailed gratis. W. D. Russell, 18 Park Place, New York.

Notes & Queries.

N. G.'s directions for placing an engine on the center originally appeared in the SCIENTIFIC AMERICAN. P. T. will find an article on glue on p. 8, vol. 32, which will probably answer his purpose.—T. S. can copper his malleable iron castings by following the instructions on p. 90, vol. 31.—D. J. W. and others are informed that we have frequently recommended courses of study to young engineers that we cannot repeat them.—F. B. L. can make a waterproof varnish for cloth by following the instructions on p. 74, vol. 31.—G. M. can solder brass to iron by following the directions on p. 251, vol. 28.—F. D. will find directions for drying raisins on p. 409, vol. 31.—S. C. D. will find directions for making fulminate of silver on p. 90, vol. 31.—S. E. S. can produce a dead black on brass work by the process given on p. 362, vol. 25.—W. H. L. can transfer pictures to glass by using the process detailed on p. 123, vol. 30.—C. E. F. will find an answer to the question as to the ball falling through the earth on pp. 158, 250, vol. 31.—C. J. will find directions for obtaining albumen from blood on p. 344, vol. 31.—C. R. can use up his coal dust by following the directions given on p. 571, vol. 24.—G. can temper turning and boring tools by following the process described on p. 21, vol. 31. As to horse power of an engine, see p. 33, vol. 33.—S. H. D. will find a recipe for an alloy for making models, etc., on p. 91, vol. 30.—W. S. will find directions for making matches on p. 75, vol. 29.—L. E. O. will find that the gyroscope is lucidly described on p. 91, vol. 31.—W. B. T. can preserve leaves and flowers by the process given on p. 296, vol. 31.—F. S. will find a description of a wooden railroad on p. 358, vol. 31.—J. M. McC. can detect cotton in line woods by the method described on p. 102, vol. 28.—T. K. G. will find a recipe for a composition for explosive bullets on p. 300, vol. 33.—L. J. F. will find directions for refining cotton seed oil on p. 19, vol. 30.—C. S. can glue his rubber rollers to the wooden spindles. For a recipe for utilizing old rubber, see p. 33, vol. 27.—D. A. R. can clean ivory by the process described on p. 10, vol. 32.—M. R. W. will find rules for calculating the proper cut off of an engine on pp. 37, 69, vol. 32.

(1) C. R. M. says: I am going to cover a boiler with staves one inch thick, tongued and grooved; the staves do not fit close to the surface on account of rivet heads. Would charcoal dust mixed with clay be a good thing to put between the boiler and the staves? A. Clay alone will probably answer as well.

(2) G. C. B. and others desirous of entering government service as engineers should apply to the Secretary of the Treasury; and if there are any vacancies in the engineer corps, they will receive full information.

(3) T. B. J. asks: 1. What power should be obtained from steam issuing from a quarter inch round pipe at 80 lbs. pressure by a good non-condensing engine? A. We would like some further particulars. 2. Has any rotary engine hitherto constructed given as much power from the same steam as a plain reciprocating engine? A. There is not much information in print about the performance of rotary engines; but as far as the records go, the advantage is with the reciprocating engines.

(4) A. H. asks: If the smoke stack on a locomotive be cut off about one foot above the boiler, will that reduce the power? If so, in what proportion may grate area and heating surface be increased to remedy the loss? A. If the blast continues effective, there would be little difference.

(5) B. L. G. says: 1. I have a vertical stationary 4x5 engine, with a vertical boiler 6 feet high, 30 inches outside diameter, with 40 two inch tubes 4 feet long in it. How much power will I get with 50 lbs. steam? A. Probably between 3 and 4 horse power. 2. The heat is now arranged passes through the tubes and up the chimney. To economize fuel, I propose to put a sheet iron jacket over the boiler, to within 6 or 8 inches of the bottom, with another outside of that, reaching from the bottom and made tight, the pipe to the chimney leading from near the top of this. The

heat would then pass up the tubes, down between the shell of the boiler and the inner jacket, and up between the jackets to the chimney. Would this be advisable? If so, how much space would be necessary between boiler and jacket? The draft is good. 3. It might be better to leave off the second jacket. Make space about the same as the cross section of tubes. 3. I would like to use the exhaust for heating; would it be advisable to run it through 150 feet of pipe with 8 elbows? Should I use a back pressure valve? A. It would be advisable to have a back pressure valve in this case. 4. What size of pipe would be best? A. The larger the pipe you use, the better.

(6) H. M. says: 1. Please give me the dimensions of a boat for an engine 3x3 inches. A. Make a boat 20 feet long by 5 feet wide. 2. How large a wheel should I use? A. Use a propeller from 20 to 24 inches in diameter, and 2½ to 2¾ feet pitch. 3. The boiler is 23 inches long and 14 inches in diameter, and has nineteen 1½ inch flues, with firebox 13 inches high and 14 inches in diameter. It is made of ¼ inch plates. Heads are ½ inch thick. How much steam can I carry? A. About 130 lbs. per square inch, if your boiler is well made.

(7) N. Y. says: 1. I wish to supply 90 gallons of water per hour at 160° Fah. through a 1 inch pipe. The temperature of the space about the pipe is 325°, and the incoming water 30°; what must be the length of pipe? A. You will have to determine the matter by experiment. 2. As it would take a different length to raise the temperature to 200°, or a different length still of 2 inch pipe to raise the same to 160° or 200°, by what formula can a solution be obtained? A. Possibly some of our readers may have information on the subject. If so, we would be glad to hear from them, as the subject is one of great interest. We could give you approximate formulas, but they would not be very safe guides.

(8) E. H. K. asks: I have an upright boiler, 12 inches in diameter by 2 feet high, with nineteen 1½ inch tubes, 6 inches water space above tube sheet, and 8 inches space below crown sheet. She lifts her water a great deal, and I think of carrying the water 6 inches above crown sheet. Is there any danger in having water below the tube sheet? Will the dampness of steam keep the tubes not surrounded with water or above the water safe from burning? A. It is very common to run vertical boilers with the water a few inches below the upper tube sheet.

(9) C. and B. say: We are building a boat, 18 feet in length by 4 feet beam and 6 inches draft forward and 8 inches aft, to run on very still water. What size of screw propeller will it require to run it at ten miles an hour? A. The boat will not carry the machinery necessary for that speed.

(10) W. H. asks: How can I make a compound of metal, such as is used for plugs in low water whistles for steam boilers? A. Mix bismuth, lead, and tin, charging the relative proportions of the different metals for different melting points.

(11) M. M. says: I have an upright tubular boiler, 6¼ feet high by 34 inches diameter. The tubes are 1½ feet by 2¼ inches. The steam pressure never exceeds 70 lbs. Is it dangerous to use steam at that degree of heat? A. From your account, we do not think that you are carrying a dangerous pressure. 2. An 1½ inch pipe, from near top of boiler, leading to a steam box, had a crack about 2 feet from boiler soldered over with common solder, and the steam melted the solder off. A. The solder was probably too soft, or had too low a melting point.

(12) A. B. C. asks: In finishing my house, can the plaster be made to resemble porcelain? A. An extra hard surface and superior polish is given to plastering by the use of Keene's cement or the Parian cement, which is furnished by dealers in this city, being imported from Europe. These cements are used, either of them, in place of plaster of Paris, and probably will give the surface you require.

(13) R. S. N.—Much obliged to you for calling our attention to that curious exhibit.

(14) F. B. M. asks: 1. How can I solder silver with a blowpipe? A. Make silver solder as follows: Hard solder: Silver 4 parts, copper 1 part. Soft solder: Silver 2 parts, brass wire 1 part. 2. How can I make a good solution for cleaning silver? A. Clean silver with hot water, followed by a mixture of equal parts of spirits of ammonia and turpentine; after this, if necessary, use prepared chalk, whiting, magnesia, or rouge. 3. How can I test gold with acid? A. See p. 283, vol. 33.

(15) E. T. M. asks: What solvents are more powerful than muriatic acid? A. This depends upon the nature of the substance. Some substances insoluble in muriatic acid dissolve readily in nitric acid. And again bodies, such as gold and platinum, insoluble in nitric or hydrochloric acid alone, are dissolved by a mixture of the two. Mineral substances, containing silicates, are dissolved by hydrofluoric acid, or in a mixture of hydrofluoric and sulphuric acids.

(16) A. H. asks: 1. Has the United States government offered any reward for an indelible ink or liquid for obliterating stamps with? A. We do not know. 2. Will a preparation answer which no chemical can remove? A. The ink must, to be effective, be irremovable by chemicals or any other means.

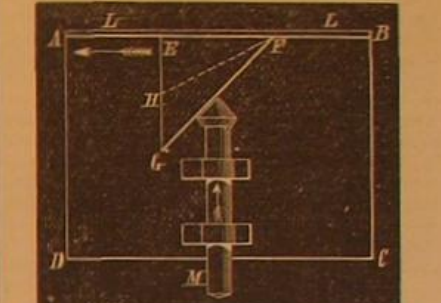
(17) J. G. asks: What is lucern, and how is it prepared for fodder for cattle? A. Lucern is a forage plant, one of the leguminosae; it is known in Spain, and in California and elsewhere, as alfalfa. Hay can be made from it, as is done with clover; but eaten green, it is an excellent food for cows. It is in full bearing in the third year, and may afterwards yield from three to five crops per season.

(18) S. C. asks: How can I dissolve india rubber, to saturate thin linen cloth with, to make it waterproof? A. Make a solution of the gum rubber in bisulphide of carbon, steep the material in this for a short time, and allow to dry in the air.

(19) W. M. B. asks: 1. Is there such an article as linoleum, made from flax seed? A. Yes it is now largely manufactured in this country, and used as a substitute for oilcloth. 2. Can it be used as a substitute for india rubber? A. We do not know that it has yet been used for this purpose.

(20) Referring to query No. 23 in our paper for October 30, an asbestos cement, recommended for verandah roofs, is manufactured by the inventor and patentee, H. W. Johns, 87 Malden Lane, N. Y.

(21) W. F. C. says, in reply to S. P. and others who doubted the superior velocity of iceboats to the wind that drives them: It is clear that L. P. is no sailor, or he would know that a boat's best point of sailing is very often not before the wind, that is to say that some boats can sail faster with the wind abeam than with it behind them. Carrying this principle to iceboats, and assuming (not taking friction of ice and wind into account) that before the wind an iceboat can sail as fast as that wind, with the latter abeam it can sail much faster. Example: Suppose a field



of ice to be represented by a table, A B C D. The wedge, G E F, is an ice boat traveling from B to A. The sliding rod, M, represents the force and direction of the wind, and the raised ledge, L L, will answer for the grooves or edges of the runners that keep the boat on her course. We will further suppose all these parts to be lubricated so as to create a minimum of friction. The G F side of the wedge represents the sail of the boat, fixed at an angle of 45° to the line of direction. If the bolt is pressed forward one inch upon the side, G F, of the wedge, the latter will be moved forward in the direction from B to A just one inch, and at equal speed. Therefore, if this one inch of motion of the boat represents the wind at 30 miles an hour, the corresponding motion of the wedge, E F G, will also be 30 miles per hour. If, however, the sail of the boat or the side of the wedge be not at an angle of 45° to the line of its direction, as at G F, but only at an angle of 22½°, as at H F, one inch of forward motion of the boat, M N, will produce two inches of motion on the wedge, H E F, so that, if the inch of motion of M N represents, as before, the wind at 30 miles an hour, the resultant motion of the wedge will represent progress of the boat at the rate of 60 miles an hour, being, of course, two to one. These figures are necessarily purely theoretical, as friction is not at all taken into account. They will, nevertheless, serve to demonstrate that which is apparently impossible—a boat traveling faster than the wind which drives it.

(22) H. A. says, in reply to L. P. S.'s query as to the running of fans: An old foundry foreman was in charge of a foundry, the proprietors of which had just put up a new fan, with wooden trough connection with the cupola. The fan was so geared that the blast could not be varied by varying the speed of the fan, as had been the practice. So our foreman proceeded to make a long slot in the side of the air trough, and over the slot he carefully fitted a sliding cover. "Now," said he, "go ahead with your blast. I'm ready for you!" Finding very soon that the blast was too strong, he slightly opened the slide in the trough to let the blast escape outwardly. But, to use his own language, "the more he opened the more she blew," and his expedient was a total failure. The next day he put in a gate as the only means of reducing the blast.

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

E. W. P.—It is decomposed mica, and consists of siliceous alumina, magnesia, lime, potash, and soda.—W. K.—We found no gold in your specimen.—D. T. M.—We cannot say how they were made. They do not contain injurious substances.—H. M.—It is an artificial stone, and has been made apparently by cementing clay, of which it is mostly composed, together with graphite, by means of some lime cement.—H. N. P.—It is composed of zinc and tin.—R. J. H.—Your specimen did not come to hand.—W. J.—It is hydrated oxide of iron, but the percentage of iron is too small to permit of its being worked profitably.

D. A. R. says: I have a bar of iron 10½ x 1½ x 1 inches, supported at one end. I wish to know how to calculate the weight which, applied to the end, will break it?—J. D. asks: How can I best weigh flax before it is fed through the cards for manufacturing into bagging?—W. L. T. asks: How can I make paper with a black surface, to be drawn on so that the lines will show the white ground through the surfacing composition?—J. A. R. asks: How do you calculate the number of gallons of oil in an oil car tank of cylindrical form with hemispherical ends, at different depths?—M. asks: How can I prepare autumn leaves for preservation?

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 Relation between Spectral Lines and Atomic Weights. By E. V.
On the Resistance of Fluids. By T. C. M.
On the Wagner Free Institute. By W. W.
On Mental Phenomena. By R. O. D.
On Mensuration. By C. H.
On Banks. By J. M.

Also inquiries and answers from the following:

A. F.—J. C. P.—A. W. A. B.—G. E. K. Jr.—N. W.—E. B. W.—F. L. K.—J. B. S.—J. C. N.—F. R. J.—S. S. T.—E. T. H.—S. H. W.—W. B. W.—E. T. J. Jr.

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.

Enquiries 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 hard rubber plates for electrical machines? Who sells microscopes? Whose is the best carriage varnish? Who sells the best telegraph wire? Who makes the best piano-forte wire? Why do not makers of firearms 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 change 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

October 19, 1875.

AND EACH BEARING THAT DATE.

(Those marked (r) are retained patents.)

Alarm for prisons, etc., Cook & Heath.....	168,571
Anchor, T. J. Whitecar.....	168,569
Apple-paring machine, W. M. Griscom.....	168,585
Apple-paring machine, A. Rippen.....	168,549
Bars, drawing and polishing, D. I. Farmer.....	168,575
Bedstead, invalid, Watson & Kelso.....	168,567
Bedstead, sofa, J. L. Closterman.....	168,577
Blitz protector for vessels, B. Edgar.....	168,574
Blasting detonating cap, J. Goldmark.....	168,585
Boiler for steam fire engines, J. N. Dennison.....	168,573
Boiler indicator, steam, A. Moon.....	168,513
Boot, A. A. Cuming.....	168,582
Boot and shoe, E. S. Justh.....	168,506
Boring machine, Wilder, McNeill, & Tyler.....	168,582
Bottle stopper, E. H. Hunt.....	168,500
Bottle mold, P. W. Reid.....	168,508
Bracelet, J. N. Thomson.....	168,535
Brick machine, S. Martin.....	168,511
Bride bit, J. Thornton.....	168,557
Burner, Argand et al.....	168,546
Buttons, etc., attaching, D. Heaton.....	168,594
Calendar, C. Z. O'Neill.....	168,516
Candlestick, A. Albertson.....	168,522
Capacitor, artificial, A. G. Day (r).....	6,705
Caoutchouc, forming artificial, A. G. Day (r).....	6,708
Car coupling, D. A. Newsum.....	168,515
Car refrigerator, J. E. Acklom.....	168,553
Car springs, D. R. Pratt.....	168,545
Car starter, M. Toulmin.....	168,540
Car ventilator, A. Hance.....	168,557
Cars, air spring for, P. Giffard.....	168,590
Carbureter, L. Marks.....	168,510
Carbureter, J. M. Pollard.....	168,534
Chair, A. H. Brick.....	168,528
Chair, T. Tostevin.....	168,565
Chair bottom, T. Tostevin.....	168,564
Chair, folding, Benn & Box.....	168,565
Chair, folding, I. N. Dunn.....	168,583
Chair, folding, G. McAleer.....	168,515
Chair, folding, A. D. Whitmore (r).....	6,711
Chair, nursery, A. E. Barnes.....	168,560
Chair, opera, Chase & Ball.....	168,574
Chuck, H. A. Kimball.....	168,557
Chuck for rock drills, H. Thomas.....	168,538
Churn, reciprocating, E. A. Firby.....	168,576
Cigar lighter, glass, W. A. Gorby.....	168,551
Cigar lighters, making, N. Fuller.....	168,525
Clamp, joiner's, G. A. Nussman.....	168,527
Clock, electric, D. F. Sweet.....	168,557
Clothes dryer, G. Myers.....	168,543
Coffee roaster, F. Thomas.....	168,559
Coke oven, scraper for, P. M. Buttermore.....	168,568
Colter, G. C. Lyons.....	168,540
Composition, friction, J. G. Steele.....	168,525
Compound, anti-friction, C. C. f. Otto.....	168,521
Cradle, F. Voll.....	168,545
Curtain fastener, R. J. Pospisil.....	168,521
Dental engine, hand piece for, W. A. Johnston.....	168,533
Desk and baggage check box, G. E. Nichols.....	168,528
Disinfecter and inhaler, H. G. Dayton.....	168,572
Ditching machine, M. E. Burtless.....	168,567
Dock, floating, Clark & Standfield.....	168,510
Door knob, A. Rankin.....	168,536
Door knob, making china, N. Koch.....	168,536
Drilling machine tripod, J. B. Waring (r).....	6,705
Drills, chuck for rock, H. Thomas.....	168,538
Dust pan, E. Kramm.....	168,589
Dyeing and calico printing, J. Harley.....	168,591
Eaves trough, O. W. Stearns.....	168,594
Egg-turning device, R. Tyler.....	168,542
Electric machine, magneto, J. B. Fuller.....	168,530
Engine governor, steam, N. E. Nash.....	168,574
Engine, rotary, G. D. Harwood.....	168,537
Engine condensing apparatus, J. Houtp.....	168,501
Engine differential gear, J. B. Annis.....	168,565
Fals, purifying, J. P. Kinney.....	168,508
Fanest, C. A. Douglas (r).....	6,708
Fanest, J. M. Hopkins.....	168,597
Fiber bar, wire, L. M. Devore.....	168,586

Fence, farm, J. P. Monnett.....	168,573
Fender, O. W. Hoyt.....	168,599
Filter and sprinkler, Bachelor & Warren.....	168,525
Fire arm, breech-loading, A. Burgess.....	168,529
Fire arm magazine, A. Burgess.....	168,566
Fire arm detachable grip, F. W. Freund.....	168,534
Fire arms, implement for, A. E. Barthel.....	168,523
Fire extinguisher, E. A. Maginness.....	168,513
Flask, W. H. Stroup.....	168,525
Flue scraper, A. Fisher.....	168,531
Fluting machine, H. Albrecht.....	168,554
Furnace for locomotives, H. F. Hayden.....	168,599
Furnace, glue pot, T. O. Howes.....	168,598
Furnace, revolving puddling, C. Pernot.....	168,523
Furnace, puddling, C. J. Schofield.....	168,517
Gaiter, button, W. H. Miller.....	168,522
Garter, button, W. H. Miller.....	168,522
Garments, notching patterns for, A. Warth.....	168,566
Gas apparatus, Lord & McCabe.....	168,503
Gas for burning and lighting, T. B. Redwood.....	168,527
Gas process, M. W. Kidder.....	168,504
Gas retort joint, N. Jamn.....	168,501
Gas washing machinery, T. K. Lees.....	168,506
Generator, steam, D. Renshaw.....	168,523
Glue pot furnace, T. C. Howes.....	168,593
Grain binder, R. P. Rosback.....	168,543
Grain drill, Parrie & Boyle.....	168,515
Grist alarm, N. Bruner.....	168,565
Gun sight, W. M. Treadway.....	168,541
Half dressing machine, Brown & Vaughan.....	168,564
Halter and bridle, J. McKibben.....	168,541
Harmonicon, key board, G. Rimbach.....	168,547
Harvester gearing, J. F. Seiberling.....	168,530
Harvester rake, J. Barnes.....	168,559
Harvester reel, J. F. Seiberling.....	168,548
Hatchway guard, W. Muir.....	168,525
Hatchway, self-closing, W. Muir.....	168,526
Hats, etc., stiffening, E. Torlotin.....	168,563
Health lift apparatus, F. G. Johnson.....	168,502
Horseshoe, E. M. Bumpus.....	168,572
Horseshoe nail machine, J. Roy.....	168,544
Horseshoe nails, finishing, H. A. (r).....	6,712
Hose coupling, W. A. Caswell.....	168,570
Husking glove and mitten, H. L. Hall.....	168,536
Jails, construction of, Seiber & Croxton.....	168,529
Journal box, J. F. Seiberling.....	168,549
Key ring, Denio & Neer.....	168,532
Knitting landing wheel, R. W. Gormly.....	168,583
Ladder, firemen's, C. Ward.....	168,547
Ladder, firemen's folding, J. C. Christinger.....	168,575
Lamp chimney, G. M. Bull.....	168,571
Lamp chimney mold, T. B. Atterbury.....	168,563
Lamp, pocket, J. Kendall.....	168,503
Lamp, street, J. S. Hagerty.....	168,587
Latch, reversible, W. M. Griscom.....	168,596
Lathe for turning ovals, L. K. Scottford.....	168,528
Lock, combination, F. J. Chapman.....	168,573
Locomotive ash pans, cleaning, P. K. Dealy.....	168,584
Locomotive smoke stack, P. Reilly.....	168,509
Loom shuttle motion, C. I. Kane (r).....	6,702
Lubricator, Gould & Hayden.....	168,584
Malt bag catch, A. B. Whipple.....	168,560
Malt kiln floor, P. Weing.....	168,548
Measure, speed, E. Brown.....	168,570
Mill, three-high rolling, J. I. Williams.....	168,571
Mills, fore plate for rolling, J. I. Williams.....	168,570
Moss, curing, P. Unsworth.....	168,544
Mowing machine, Wood, Bowhay & Rosebrooks.....	168,551
Muff block former, E. Street.....	168,549
Nails, machine forging, J. Roy.....	168,545
Necktie retainer, W. H. Hart, Jr.....	168,526
Needle case, O. Nauen.....	168,529
Nest for fowls, S. S. & C. R. Jackson.....	168,538
Nut lock, S. G. & A. Barker.....	168,558
Nut lock, L. Chapman.....	168,530
Oil cloth, etc., binding, A. & E. A. Underwood.....	168,543
Ordnance, breech-loading, G. P. Harding.....	168,500
Ornament composition, J. G. W. Steffens.....	168,523
Paper cutting machine, S. W. Soule (r).....	6,710
Paper damping machine, J. L. Firm.....	168,578
Paper trimming machine, D. T. Broughton.....	168,563
Pavement, W. H. Jones.....	168,505
Pegging jack attachment, F. Guild.....	168,596
Pen and pencil case, W. A. Ludden.....	168,512
Pennsylvania copy, C. Allen (r).....	6,706
Picket pin, J. D. Field.....	168,530
Plating device, W. Walker (r).....	6,704
Planter, corn, Hittenhouse & Lewis.....	168,541
Pliers, parallel, H. R. Russell.....	168,524
Post, wrought iron, L. Souleris.....	168,531
Press, balling, C. C. Campbell.....	168,569
Pump, J. Bean (r).....	6,703
Pump, W. Young.....	168,552
Pump, air, J. H. Ellis.....	168,534
Pump, air, Moll and Altheide.....	168,542
Pump, chain, W. Cooper (r).....	6,700
Pump, force, W. C. Libengood.....	168,507
Purifier, middlings, A. P. Teachout.....	168,561
Railroad crossing, W. J. Stillman.....	168,533
Railroad rail joint, J. G. Holliday.....	168,500
Railroad switch, Middleton and Cary.....	168,521
Railroad switch, street, C. B. Evans.....	168,589
Rake and loader, hay, J. G. Krouse.....	168,599
Refrigerator, J. F. Ebert.....	168,533
Refrigerator and water cooler, W. Hammel.....	168,568
Relishing machine, E. F. Bohn.....	168,567
Sad iron, T. D. West.....	168,559
Sad iron shoe, V. C. Theband.....	168,537
Saddle tree, gig, A. Ortmyer.....	168,544
Sash fastener, G. G. Nodde.....	168,500
Sash holder, S. Lewis.....	168,501
Sawing machine, band, P. Prybill.....	168,505
Sawing machine, scroll, E. Herzig.....	168,595
Sawing machine, scroll, J. H. Plummer.....	168,520
Saws, etc., hardening circular, A. Schulte.....	168,527
Scales, platform, A. W. Hess.....	168,506
Scarf retainer, W. B. Hart, Jr.....	168,522
Seed dropper, J. T. Wright.....	168,572
Sewing machine, Gilman and Stiles.....	168,534
Sewing machine, G. Hancock.....	168,589
Sewing machine dress protector, E. F. Shaw.....	168,548
Shafts, etc., guard strap for, J. Weatherhead.....	168,508
Shears, metal, Livesay and Black.....	168,508
Ship's log, B. T. Moore.....	168,524
Show case, cracker, C. and W. Kroeger.....	168,535
Shutter and blind slat adjuster, etc., H. Dickerson.....	168,567
Sleigh, B. F. Sweet.....	168,506
Sole fastener, F. O. Tobey.....	168,502
Speed, device for changing, J. W. Mead.....	168,512
Spinning mule or jack, M. A. Farbusch.....	168,575
Spinning rings, etc., adjusting, J. E. Atwood et al.....	168,566
Starching machine, L. Sternberger.....	168,504
Stereotype machine, J. L. Firm.....	168,577
Stove, R. S. Bostwick.....	168,508
Stove, I. A. Sheppard.....	168,503
Stove and furnace, E. Smith.....	168,502
Stove, base burning, L. F. Betts.....	168,502
Stove, coal, Z. Hunt (r).....	6,709
Stove door knob, P. F. Washburne.....	168,535
Stove, heating, Raynaud and Marty.....	168,522
Sugar machine, cube, G. D. Jones.....	168,504

Tablet holder, eraser, D. M. Somers.....	168,580
Tacks, machine for driving, J. E. Coffin.....	168,578
Tailor's grafting apparatus, M. C. Ten Eyck.....	168,506
Target, T. H. Mead.....	168,519
Telegraph, printing, G. M. Phelps.....	168,519
Telegraph, printing, C. J. Wiley.....	168,549
Thrashing, separator shoe for, A. D. Thomas.....	168,509
Tin vessel, T. Schmitz.....	168,546
Tire tightener, J. W. Marks.....	168,517
Tire tightener, S. W. McOmber.....	168,517
Tires, machine for shrinking, H. W. Roland.....	168,542
Tool handle, T. J. Close.....	168,576
Toy, J. P. Michaels.....	168,529
Trace carrier, J. Thornton.....	168,556
Traction wheel, W. O. M. Berry.....	168,566
Truss, S. Ayres.....	168,557
Tubes, handle for boring, H. Stanley.....	168,503
Type-writing machine, R. M. J. Hansen.....	168,508
Umbrella runner, H. S. Frost.....	168,582
Valve for water mains, H. Barton.....	168,524
Vault cover, C. H. Gordon.....	168,592
Vehicle seat, E. A. Cooper.....	168,531
Vehicle top, F. H. Jury.....	168,502
Vehicles, torsional spring for, D. E. Paris.....	168,502
Ventilating apparatus, J. C. Bates.....	168,564
Ventilating cap, L. F. Betts.....	168,561
Vermix extensometer, V. Schmidt.....	168,526
Vessels, bilge protector for, B. Edgar.....	168,574
Wagon, dumping, W. M. Thompson.....	168,500
Wardrobe, folding, L. A. Colbert.....	168,579
Washing machine, J. A. Bowyer.....	168,527
Washing machine, J. H. Conaway.....	168,580
Washing machine, A. Delamater.....	168,535
Washing machine, I. A. Shaw.....	168,521
Water mains, valve for, R. Barton.....	168,524
Water meter, D. C. Taylor.....	168,554
Water wheel, centrifugal, J. H. Meacham.....	168,518
Water wheels, governor for, E. Wright.....	168,573
Weather strip, F. A. Bradshaw.....	168,569
Weed turner, Thornton, McDowell, and Hale.....	168,558
Wells, bull wheel for oil, J. Schellkopf.....	168,525
Windmill, J. Cook.....	168,581
Windmill, Orrison and Seger.....	168,517
Windmill, A. Willson.....	168,550
Windmill power, W. E. Short.....	168,551
Wrench, pipe, W. K. Stevens.....	168,552
Yarn printing machine, J. Short.....	168,502

DESIGNS PATENTED.

5,715.—Cook STOVE.—J. Brownback et al., Limerick Station, Pa.
5,719.—CANDLESTICKS.—W. Roby, East Cambridge, Mass.
5,720.—STATUARY.—J. Rogers, New York city.
5,721 to 5,739.—EMBROIDERY.—W. Steinhaus, New York city.
5,740.—CALENDAR.—J. E. Blythe, St. Louis, Mo.
5,741.—BOOK CASES.—H. S. Kerr, Philadelphia, Pa.
5,742.—CLOCK CASE.—H. J. Miller, New York city.
5,743, 5,744.—HORSE HORSES.—A. Shoemaker, Chicago, Ill.
5,745.—KNITTED SKIRTS.—S. Wallis, Newton, Mass.
5,746.—TOY MONEY BOX.—J. Murray et al., Philadelphia, Pa.

SCHEDULE OF PATENT FEES.

On each caveat.....	\$10
On each Trade mark.....	\$25
On filing each application for a Patent (17 years).....	\$15
On issuing each original Patent.....	\$20
On appeal to Examiners-in-Chief.....	\$10
On appeal to Commissioner of Patents.....	\$20
On application for Release.....	\$30
On filing a Disclaimer.....	\$10
On an application for Design (3 1/2 years).....	\$10
On application for Design (7 years).....	\$15
On application for Design (14 years).....	\$30

CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA,
October 20 to 23, 1875.

5,778.—A. O. Kirtledge et al., Salem, Ohio, U. S. Oil can. Oct. 20, 1875.
5,779.—F. C. Tapley, Clarkson, N. Y., U. S. Knitting machine. Oct. 20, 1875.
5,780.—L. Basset, New York city, U. S. Electro-magnetic engine. Oct. 23, 1875.
5,781.—W. M. Adams, Toronto, Ont. Chimney cow. Oct. 23, 1875.
5,782.—L. O. Root, Minneapolis, Minn., U. S. Safety runners for railroad cars. Oct. 23, 1875.
5,783.—G. B. Durkee, Alden, New York city, U. S. Soap hook. Oct. 23, 1875.
5,784.—I. N. Richardson, Malden, Mass., U. S. Playing cards. Oct. 23, 1875.
5,785.—S. W. Steele et al., Northfield, Vt., U. S. Process of marbling surfaces. Oct. 23, 1875.
5,786.—G. C. Eastman, Lewiston, Me., U. S. Flour sifter. Oct. 23, 1875.
5,787.—S. Landon, Iroquois, Ont. Oil tank. Oct. 23, 1875.
5,788.—G. F. Simonds, Fitchburg, Mass., U. S. Process of forming and tempering saws. Oct. 23, 1875.
5,789.—G. Leverick, Brooklyn, N. Y., U. S. Elastic hub for vehicles. Oct. 23, 1875.
5,790.—W. P. Widdell, Sloom, Ont. Wheeled vehicle brake. Oct. 23, 1875.
5,791.—W. E. Andrew, New York city, U. S. Making butter from the oils of animal fat. Oct. 23, 1875.
5,792.—C. Martin, Toronto, Ont. Construction of ventilators. Oct. 23, 1875.
5,793.—S. B. Strong, Albion, N. Y., U. S. Pump. Oct. 23, 1875.
5,794.—N. Kimball, London, Ont. Portable and stationary fence. Oct. 23, 1875.
5,795.—G. W. Cottingham, Rockport, Tex., U. S. Sad iron. Oct. 23, 1875.
5,796.—G. W. Cottingham, Rockport, Tex., U. S. Machine for ironing clothes. Oct. 23, 1875.

Advertisements.

Back Page - - - - - \$1.00 a line.
Inside Page - - - - - 75 cents 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.

P. BLAISDELL & CO.,

Worcester, Mass.,
Manufacturers of the Blaisdell Patent Upright Drills and other first-class Machinery's Tools.

STEEL CASTINGS.

Solid and Homogeneous. Guaranteed tensile strength, 30 tons to square inch. An invaluable substitute for expensive forgings, or for Cast Iron requiring great strength. Send for circular and price list to CHESTER STEEL CASTING CO., Avalon St., Philadelphia, Pa.

OPIUM AND MORPHINE HABIT CURED.

The ORIGINAL and ONLY Cure prepared.
Send stamp for book on Opium eating, to
W. B. SQUIRE, M.D.,
Worthington, Greene Co., Ind.

Hoosac Tunnel Machinery FOR SALE.

Steam Engines and Boilers, Burleigh Compress

Important New Scientific Books.

Treatise on Steam Boilers: their Strength, Construction, and Economical Working. By Robert Wilson. 3rd edition, 12mo., cloth, \$3.00.

The Mathematical Theory of the Steam Engine, with Rules at length, and Examples worked out for the use of Practical Men. By T. Baker. 12mo., cloth, 75c.

The Construction and Management of Steam Boilers. By R. Armstrong. With an Appendix by H. Mallet. 12mo., \$2.50.

The Operative Mechanic's Workshop Companion and Scientific Gentleman's Practical Assistant. By William Templeton. \$2.50.

A Pocket Book of Useful Tables and Formulae for Marine Engineers. By Frank Proctor. Full Bound. (Pocket Book form) \$2.00.

A Rudimentary Treatise on Clocks, Watches, and Bells. By Sir Edmund Beckett, Bart. 12mo., \$1.75.

The Coach Maker's Illustrated Hand Book, containing Complete Instructions in all the different Branches of Carriage Building. Edited by I. D. Ware. Second Edition. 8vo., \$3.00.

Gasfitters' and Plumbers' Companion—A Clear and Comprehensive Treatise bearing on all the important Points of the Business, with Valuable Receipts, etc. By Jos. D. Galloway, Gas Engineer. 12mo., Paper, 75 cents. Cloth, \$1.00.

Water Works for the Supply of Cities and Towns. By Samuel Hughes. 12mo., \$2.00.

Gas Works, and the Practice of Manufacturing and Distributing Coal Gas. By S. Hughes. 12mo., \$1.75.

Hydraulic Tables, Co-Efficients and Formulae for Finding the Discharge of Water from Orifices, Notches, Weirs, Pipes and Rivers. Illustrated. 12mo., \$7.00.

The Commercial Hand Book of Chemical Analysis. By A. Normandy. New Edition. Edited by H. M. Noyd, Ph.D. 12mo., \$6.25.

Treatise on Coal and Coal Mining. By W. W. Smith. 12mo., \$1.75.

Hints to Young Architects. By Wightwick. Edited by G. H. Guillaume. 12mo., \$2.00.

77 The above, or any of our Books, sent by mail, free of postage, at the publication price.

Having removed to new premises, which we have specially fitted up for our own use, with greatly increased facilities, we shall in future keep on hand, in addition to our own publications, a large and valuable stock of

AMERICAN AND ENGLISH

Practical and Scientific Books, IN ALL DEPARTMENTS.

77 Books imported to order from Europe.

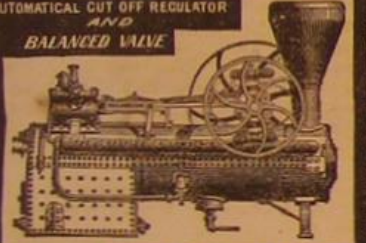
Our new and enlarged CATALOGUE OF PRACTICAL AND SCIENTIFIC BOOKS—36 pages, 8vo.—sent free to any one who will furnish his address.

77 A Select List of Books on Metals, Metallurgy, Strength of Materials, Chemical Analysis, etc.; also, one on Steam and the Steam Engine, as well as a Catalogue of a Choice Collection of Practical, Scientific and Economic Books, with prices, sent free upon application.

HENRY CAREY BAIRD & CO., INDUSTRIAL PUBLISHERS, BOOKSELLERS AND IMPORTERS, 510 WALNUT STREET, Philadelphia.

The HOADLEY PORTABLE STEAM ENGINE.

WITH AUTOMATIC CUT OFF REGULATOR AND BALANCED VALVE.



STATE WHERE YOU WANT THIS

THE BEST & MOST ECONOMICAL ENGINE MADE

SEND FOR CIRCULAR.

THE J.C. HOADLEY CO. LAWRENCE, MASS.

TO ENGINEERS, MACHINERY MANUFACTURERS, Tool Makers, Patentees and others—The undersigned influential and well established firm, carrying on business in Melbourne, the principal of which has had over 20 years' experience in the Australian Colonies, and which has a large and extended connection, is willing to undertake the sole agency in the above Colonies for the sale of all classes of Engines, Agricultural Machinery, Engineers' Tools, Mechanical Inventions and Patents, and also to transact every description of business in this class. Highest references given. DAVID MUNRO & CO., 151 Queen Street, Melbourne.

LeCount's Patent MACHINIST'S TOOLS.

Reduced Prices.

Set Iron Dogs, 2 to 12 in. \$5.00

" Steel " " " " " " \$12.00

" " " " " " " " \$6.30

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.

Shriver's Hydraulic Organ Blower may be seen at the American Institute Fair, blowing a large Church Organ. Send for circular to T. SHRIVER & CO., Manufacturers, 333 E. 56th St., New York.

Brainard Milling Machines all styles. A new Universal Milling Machine for \$200. Also Brown's Pat. SCREW MACHINES, and our new Brainard STEEL BAR VISE. B. M. M. CO., 131 Milk St., Boston, Mass.

NEW & SECOND HAND WOOD WORKING Machinery, Floorers, Planers and Matchers, Single and Double Surfaces, Moulding Machines, Scroll Saws, Section and Blast Fans for Shavings, etc. D. J. LATTIMORE, 31st and Chestnut St., Philadelphia, Pa.

VINEGAR HOW MADE IN 10 HOURS from Cider, Wine or Molasses, without using drugs. Address F. L. BAGE, Vinegar Maker Springfield, Mass.

PATENT WOOD WORKING MACHINERY

PLANING & MATCHING, MOULDING, MORTISING, TENONING, RESAWING, SHAPING BAND & SCROLL SAWS &c. &c.

J.A. FAY & CO.

CINCINNATI, O.

CLARK & COMPANY'S PATENT SELF-COILING, REVOLVING STEEL SHUTTERS

Can be readily fitted to Store Fronts, Rear Windows or other openings, making them FIRE AND BURGLAR PROOF, and affording absolute protection; also, WOOD SHUTTERS in various kinds of wood, suitable for Store Fronts, Private Houses, Offices, and School Partitions. Clark's shutters are self-acting, require no machinery or balance weights, and cannot get out of order. They are handsome in appearance, and are the best and cheapest shutters in the world. Are fitted to the new Tribune Building, Delaware and Hudson Canal Building, Manhattan Building, Lenox Library Building. Have been for years in daily use in every principal city throughout Europe, and are endorsed by the leading architects of the world.

AGENTS WANTED.

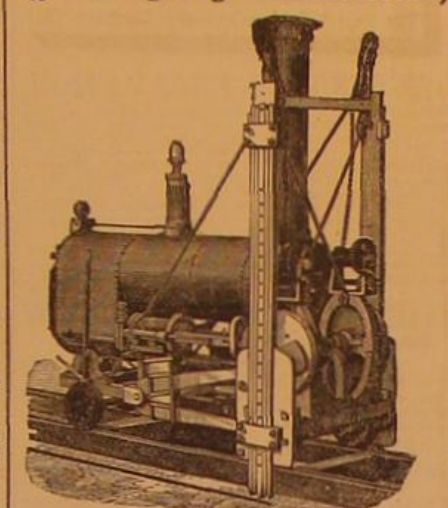
\$5 to \$20 per day at home. Samples worth \$1 free. STINSON & CO. Portland, Maine.

The TOLL-GATE! Prize Picture sent free! An ingenious gem! 50 objects to find! Address with stamp, E. C. ABBEY, Buffalo, N. Y.

TO ELECTRO-PLATERS, JEWELERS, AND WATCHMAKERS. BATTERIES, CHEMICALS, AND MATERIALS, in sets or single, with Books of Instruction for Nickel or Silver Plating. THOMAS HALL, Manufacturing Electrician, 19 Bromfield Street, Boston, Mass. Illustrated Catalogue sent free.

\$77 A WEEK to Agents, Old & Young, Male & Female, in their locality. Terms & OUTFIT FREE. Address P. O. VICKERY & CO., Augusta, Me.

Stone Channeling OR Quarrying Machine,



WARDWELL PATENT, FOR CUTTING STONE INTO VARIOUS SIZES AND DIMENSIONS IN ALL KINDS OF QUARRIES. STEAM STONE CUTTER CO., RUTLAND, VT. SOLE PROPRIETORS AND MANUFACTURERS.

THE NEW Elements of Hand-Railing. REVISED EDITION. Containing Forty-one Plates, THIRTEEN of which are PERFECTLY NEW, with letter-press descriptions. By Robert Riddell, author of the "Carpenter and Joiner," and "Hand-Railing Simplified." 1 vol., Folio, cloth, \$7.00. CLAXTON, REMSEN & HAFELINGER, 221-223 Market St., Philadelphia, Pa.

\$10 to \$500 INVESTED in Wall Street often leads to fortune. A 72 page book, explaining everything, and copy of the Wall Street Review. JOHN HICKLING & CO., Bankers and Brokers, 72 Broadway, N.Y.

FOR SALE—The right to Manufacture the William Greet Iron, Cotton, and Hay Hook Bale Tie. Patented July 27, 1875. This Tie is superior to all others, as it can be used an indefinite number of times. For Drawings, etc., apply to WILLIAM GREET, Mount Vernon, Va. (Ironstone County, Alabama).

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 Try Street, 2nd and 3rd Avenues, Pittsburgh, Pa. 100 S. Canal Street, Chicago, Ill.

Stocks of this Shafting in store and for sale by FULLER, DANA, & FITZ, Boston, Mass. GEO. PLACE & CO., 131 Chambers St., N.Y. PIERCE & WHALING, Milwaukee Wis.

\$250 A MONTH—Agents wanted everywhere. Business honorable and first class. Particulars sent free. Address J. WORTH & CO., St. Louis, Mo.

E. M. MAYOR'S PATENT BOLT CUTTER. Send for Illustrated Circular, Cincinnati, Ohio.

FINE TOOLS For Machinists, Jewelers, Engravers, Watchmakers, Amateurs and others. Also, a fine assortment of File and Steel Wire Supplies, at FRASER & CO.'S, 62 Chatham Street, New York.

PATENT Planing and Matching and Moulding Machines, Gray and Wood's Planers, Self-acting Saw Arbors, and other wood-working machinery. S.A. WOOD'S MACHINE CO., 91 Liberty St., N.Y. Send for Circulars, etc. 161 Sudbury St., Boston.

10 DECALCOMANIE, or TRANSFER PICTURES, with each of 25 cts., giving full instructions in use, new and beautiful art, sent post-paid for 10 cts. They can be easily transferred to any article as to imitate the most beautiful painting. Also, 5 beautiful GEM CHROMOS for 10 cts. 1 set for 25 cts. Agents wanted. Address J. L. PATTEN & CO., 322 William Street, New York.

THE CHRISTIAN UNION.

REV. HENRY WARD BEECHER, Editor. Ellinwood's authorized verbatim reports each week of Mr. Beecher's

Sermons in Plymouth Church. All his literary productions, including the characteristic "STAR PAPERS," will be given. Serial Stories by

REV. EDWARD EVERETT HALE, D.D., (Author of a "Man without a Country," &c.)

HON. ALBION W. TOURGEE, Judge of the Superior Court of North Carolina, (Author of "Tolstette," &c.)

MRS. HARRIET BEECHER STOWE, (Author of "Uncle Tom's Cabin," &c.)

A Comprehensive Family Religious Newspaper. Terms \$3.20 per year, postage prepaid.

New and Unusual Terms to Agents.

Cash Commissions and Competitive Premiums in Cash.

\$2,000 Given Away!

Send for particulars.

HENRY M. CLEVELAND, Publisher. HORATIO C. KING, Asst. Publisher. 27 Park Place, New York.

WASHINGTON, D. C., Sept. 12, 1875.

JNO. MATHER, Treas. Valley Machine Co., East Hampton, Mass.

Dear Sir: The "Wright Bucket Plunger Steam Pump" you built for the Government "works like a top." Am sure it has never had its equal in any of the Departments, and I have no hesitancy in recommending this Pump to any one in want of a first class, noiseless Steam Pump. Very respectfully, J. THOS. MILLER, Chief Engineer U. S. House of Representatives. Send to us for Catalogue. V. M. COMPANY.

The Myers Portable Engine, 4.5, 6, 8 h.p. Something new. Best for price. Circulars, SECOND-HAND IRON MACHINERY, AND WOOD WORKING MACHINERY. CHAS. PLACE, 103 Reade Street, New York.

8,000 in Use Blake's STEAM PUMPS for every possible duty. Send for Illustrated Catalogue. GEO. F. BLAKE MFG CO. 36 & 38 Liberty Street, New York.

Cor. Causeway and Friend Sts., Boston, Mass. 50 and 52 South Canal St., Chicago, Ill.

WROUGHT IRON BEAMS & GIRDERS

THE UNION IRON MILLS, Pittsburgh, Pa.—The attention of Engineers and Architects is called to our improved Wrought-Iron Beams and Girders (patented), in which the compound welds between the stem and flanges, which have proved so objectionable in the old mode of manufacturing, are entirely avoided. We are prepared to furnish all sizes at terms as favorable as can be obtained elsewhere. For descriptive lithograph, address Carnegie Brothers & Co., Union Iron Mills, Pittsburgh, Pa.

Call at Fair American Institute and See NEW DRAWING PRESS & OTHER TOOLS. STILES & PARKER PRESS CO., Middletown, Ct. Will meet parties by appointment.

OPIMUM and Morphine habit absolutely and speedily cured. Painless; no publicity. Send stamp for particulars. Dr. Carl-ton, 157 Washington St., Chicago, Ill.

WITHERBY, RUGG & RICHARDSON, Manufacturers of Woodworth Planing, Tongueing, and Grooving Machines, Daniel's Planers, Richardson's Patent Improved Tenon Machines, Mortising, Moulding, and Re-Saw Machines, and Wood-Working Machinery generally, 35 Salisbury Street, Worcester, Mass. (Shop formerly occupied by B. BALL & CO.) L. B. WITHERBY, G. J. RUGG, S. M. RICHARDSON.

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

\$500 IN GOLD GIVEN AWAY, also 50 per cent Commission. You can make from \$10 to \$30 daily. FAMILY JOURNAL CO., 292 Broadway, N. Y.

WILLIAM HENRY KING—ALBUMEN MANUFACTURER, 78 & 80 St. Andrew Street, Liverpool, Eng.

SAFETY HOISTING OTIS' Machinery. OTIS, BROS. & CO. NO. 348 BROADWAY, NEW YORK.

WHIPPLE'S Patent Door Knob. Awarded a Bronze Medal at the American Institute Fair for 1874. The Judges say: "We consider this method of fastening DOOR KNOBS a great improvement over anything yet invented for the purpose, as it obviates the use of side screws and washers, and can be regulated to suit any thickness of Doors." Send for Circular. THE PARKER & WHIPPLE COMPANY, West Meriden, Conn., or 97 Chambers St., N. Y.

Todd & Rafferty Machine Co. MANUFACTURERS OF The celebrated Greene Variable Cut-Off Engine; Luwa's Patent Tubular and Fine Boilers; Plain Slide Valve Stationary, Hoisting, and Portable Engines. Boilers of all kinds, Steam Pumps, Mill Gearing, Shafting, &c., &c., Tow Ovens, Baking, Hoops, Flax, and Hemp Machinery. Agents for the New Haven Manufacturing Co.'s Machinery; Tools for Judson's Governors and Stop-Valves; Sturtevant Blowers; and Differential Pulley-Blocks. WAREHOUSES, 19 BAILEY STREET, NEW YORK. WORKS PATERSON, NEW JERSEY.

STEAM PUMPS.

FIRST PRIZES, VIENNA, PARIS, NEW YORK, BALTIMORE, BOSTON. Send for circular of recent patented improvements. THE NORWALK IRON WORKS, South Norwalk, Conn.

BOOKWALTER ENGINE

Compact, Substantial, Economical, and Easily Managed. Guaranteed to work well and give full power claimed. Engine and Boiler complete, including Governor, Pump, &c., with shipping boxes, at the low price of

3 Horse Power.....\$22 00

4 1/2 " " " " " " " " 36 50

12" Put on Cars at Springfield, Ohio. Address

JAS. LEFFEL & CO., Springfield, Ohio; or 109 Liberty St., New York City.

WOODWORTH SURFACE PLANERS \$125. Planers and 4 Matchers, \$250. S.C. HILLS, 51 Courtland street, New York.

OFFICE OF THE LONDON MFG. CO. VARNISHES

246 GRAND ST. N.Y.

MAKERS also of the famous "Varnish" for painting and varnishing. These Varnishes are made in England, and are of the highest quality. They are used in Europe and America, and are highly recommended by the most experienced artists. For full particulars, send for Circular to GEO. FAIR, Buffalo, N. Y.

IMPROVED MACHINERY FOR STAVE Heading, Shingle and Handles, Cabinet Maker's Machinery, Bailey Gauge Lathe, Durkee's Automatic Saw Mill (Improved), Key Seat Cutting, Pulley Boring, and Milling Machines, Radial Drills, Steam Engines, and Bailey's Veneering Machines, Cable and Sheaves for transmitting Power etc. to T. R. BAILEY & VAIL, Lockport, N.Y.

Can make \$5 a day in their own City or Town. Address ELLIS M'F'G CO., Waltham, Mass.

Excelsior Latest Improvement.

Double Treadle, including one doz. saws, thirty immitable Free Sawing Patterns & Preserved Wood to the value of \$1. A new device for tightening saw. Power Drilling attachment, Wrench, Oil cup, and Screw driver, Speed 80 strokes per minute. Saws 1 1/4 in. thick. Price, complete, cased and delivered on board cars, or at Express office, \$12.

SMALL STEAM ENGINE, with copper Boiler, to drive light Lathes, Scroll Saws, &c. 100 Scroll Work. Design Free on receipt of stamp. GEO. FAIR, Buffalo, N. Y.

Saw only, without Attachments, \$9.00.

DRAWING INSTRUMENTS—DRAWING Materials, Surveying Compasses, Transits, Levels, Tape Measures, Field Glasses, Spy Glasses, Microscopes, Telescopes, Barometers, &c., &c. JAMES W. QUEEN & CO., 524 Chestnut Street, Philadelphia, Pa. 601 Broadway, New York. Catalogues, Part 1st, MATHEMATICAL; Part 2d, OPTICAL; Part 3d, MAGIC LANTERNS; Part 4th, PHILOSOPHICAL INSTRUMENTS, each ten cents.

STONE SAWING MACHINERY. MERRIMAN'S PATENT, ALSO HAND AND STEAM DERRICKS & TRAVELLERS. THOMAS RESS, RUTLAND, VT.

MACHINERY

IRON & WOOD WORKING MACHINERY OF EVERY DESCRIPTION.

Cold Rolled Shafting.

HANGERS, PULLEYS, COUPLINGS, BELTING, &c. Send for Illustrated Catalogue and Price List. GEORGE PLACE, 121 Chambers & 133 Reade Sts. N. Y. City.

BLAKE'S PATENT Stone and Ore Breaker Crushes all hard and brittle substances to any required size. Also, any kind of STONE for Roads and for Concrete, &c. Address BLAKE CRUSHER CO., New Haven, Conn.

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., 85 & 91 Liberty St., New York.

Planing & Matching. Moulding, Re-sawing and Tenoning Machines. Scroll Saws and General Wood-Working Machinery. JOHN B. SCHENCK'S SONS, Mattawan, N. Y. Send for Catalogue. 115 Liberty St., N. Y. City

Bradley's Cushioned Hammer has larger capacity, is more durable, takes up less room, does more and better work with less expense for power and repairs than any other Hammer in use. Guaranteed as recommended. Address BRADLEY Manufacturing Company, SYRACUSE, N. Y.

Machinists' Tools. All sizes at low prices. E. GOULD, Newark, N. J.

GEO. W. READ & CO., STEAM HAND SAW AND VENEER-CUTTING MILL, 106 to 200 LEWIS ST., foot 5th & 6th Sts., E. R., N. Y. Always on hand, FULL STOCK OF SEASONED

Hard-Wood Lumber AND CHOICE FIGURED VENEERS. The LARGEST STOCK! The GREATEST VARIETY! The Lowest Prices! 25¢ Enclose Stamp for Catalogue and Price-List. Orders by mail promptly and faithfully executed.

5000 AGENTS WANTED—To Sell the Oriental Stationery and Jewelry Package, the largest and fastest selling package in the world. Mailed for \$30. Address R. L. FLETCHER, 111 Chambers St., New York

Advertisements.

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

Engine, Spindle, & Cylinder Oil. E. H. KELLOGG,
 17 Cedar St., N. Y., manufactures the best. Established '58.



Quackenbush's Amateur Lathe.

PRICES.
 Lathe, \$10.00
 Foot Power, 6.00
 Countershaft, 6.00
 Scroll Saw Attachment, 5.00

H. M. Quackenbush

PATENT & MANUFACTURER
 Herkimer, N. Y.

Liberal Terms to the Trade.

SEND

FOR

CIRCULAR.

Schlenker's Stationary

AND

Revolving - Die Bolt Cutters,
 MANUFACTURED BY THE

HOWARD IRON WORKS,
 BUFFALO, N. Y.

Send for Circular.

Dr. Feuchtwanger's Treatise on
SOLUBLE GLASS.

In all its practical bearings and manifold applications in
 the Arts. THIRD EDITION.

WANTED—By a capable and energetic busi-
 ness man about going to San Francisco, Cal., an
 Agent for any desirable Patent or Manufactured Arti-
 cles. The writer has an extensive acquaintance in gen-
 eral mercantile and manufacturing businesses, and in-
 tends devoting his whole time to the general agency busi-
 ness. First class references can be given. Persons desir-
 ous of employing such a one, will address, for ten
 days, Box 598, Pittsburgh P. O., Pa.



Shaping Machines

Have novel device for changing
 length of stroke while in motion,
 also, automatic down feed, and
 quick return. Four sizes.
 Patented 1868, 1871, 1874.

Wood & Light Machine Co.
 Worcester, Mass.
 Manufacturers of all kinds of
 Iron Working Machinery
 Shafting, Pulleys, &c.

MAGNETS—Permanent Steel Magnets
 of any form or size, made to order by F. C. BEACH
 & CO., 246 Canal St., New York. Makers of the cele-
 brated Tom Thumb and Miniature Telegraph Instru-
 ments.

FREE
 100 page Book and samples of
 Rubber Roofing. Complete
 materials for new roof, 4 1/2 c. a ft.
 Fire-proof, durable, cheap. Easily
 applied with positive satisfaction.
 Write at once and save money.
 N. Y. Slate Roofing Co.,
 CEDAR ST., N. Y.

State where you saw this notice.

ENGINES & BOILERS new & 2d h'd. perfect condition.
 Very cheap. Address BINGHAM & RICH, 101 City, Pa.

Our Boiler and Pipe Covering
 Save 25 PER CENT.
 in FUEL.

ASBESTOS FELTING COMPANY,
 316-322 FRONT ST., New York.

HASKELL'S THREE CYLINDER PUMP—
 Hand or Power. Cheaper than a Steam Pump.
 Will outwear a Rotary Pump—do more work, with less
 power, than any other pump. Not liable to get out of
 order. Any blacksmith can repair it. Adapted to any
 kind of hard work. Send for Circular.
 CHASE MACHINE COMPANY, Boston, Mass.

THE HEALD & SISCO
 Patent Centrifugal Pumps.

VERTICAL & HORIZONTAL.
 First Premiums at New Orleans, Cincinnati, and New
 York. "Medals of Special Award,"
 American Institute, 1874.

Perfect satisfaction guaranteed. The cheapest, simplest,
 strongest, most efficient and popular Pump in use, for
 emptying Dry-docks, Coffers, etc., and for use in
 Paper Mills, Tanneries, and Factories. STEAM PUMPS
 very low, for Wrecking, Dredging, Irrigating, etc. Illus-
 trated pamphlet, free. Nearly 1,000 references to actual
 customers. 21 pages first-class testimony. Address
 HEALD, SISCO & CO., Baldwinville, N. Y.

NOYE'S
Mill Furnishing Works

are the largest in the United States. They make Burr
 Millstones, Portable Mills, Run Millstones, Packers, Mill
 Picks, Water Wheels, Pulleys and Gearing, specially
 adapted to flour mills. Send for catalogue.
 J. T. NOYE & SON, Buffalo, N. Y.



LOW-PRICED EMERY WHEELS

Made and introduced by inexperienced men, have resulted in failure, dissatisfac-
 tion and distrust of all Emery Wheels. Standard and reliable goods (which can
 not be sold at a low price), when bought direct from the maker, properly intro-
 duced and treated with the same care as other first-class tools, yield first-class
 results. No metal working tool in existence will save as much money as will a
 well mounted Emery Wheel. Emery Wheels will readily shape hardened steel
 and chilled iron which resist all the efforts of other tools. A Tanite Wheel, prop-
 erly mounted and used by a skilled man, will do as much work in a day as the man
 could do with file and vice in a week. The introduction of 6 machines in one
 factory enabled the proprietor to dispense with the labor of 30 men. Every man-
 ufacturer can afford to buy one Emery Grinder for every two vices in his fac-
 tory. Deal only with standard makers, and you buy their experience as well as
 their goods. Address
THE TANITE CO.,
 Stroudsburg, Monroe Co., Pa.

PURE EMERY.

Guaranteed equal to any in the market, at prices lower than any other first class Emery.

JUST OUT.



WRINKLES AND RECIPES

Scientific American

An Illustrated Hand-Book of Practical
 Hints and Suggestions for Mechanics,
 Engineers, Farmers, Housekeepers,
 and Workmen generally.

EDITED BY PARK BENJAMIN.

Contents.

DEPARTMENT OF MECHANICS.

Master-Tools, accurately represented. How to make
 and use them. Valuable suggestions for management of
 Machine Tools. Hints for Casting, Forging, Temper-
 ing, etc. Trade Secrets and Wrinkles. The whole super-
 vised by JOSHUA ROSE.

DEPARTMENT OF ENGINEERING.

The management, construction, and repair of Boilers,
 Engines, Valves, Shafts, Belts, Pulleys, and Hangers.
 Brief rules for practice, etc., prepared by Mr. R. H.
 BURL. Also, New Paper on Testing Metal, expressly
 written by PROF. R. H. THURSTON, C.E., who also su-
 pervises the entire Department.

DEPARTMENT OF PRACTICAL TECHNOLOGY.

Supervised by PROF. P. H. VANDER WEYDE, M.D.
 Metallurgical Operations; Cements and Glues; Painting
 and Varnishing; Making simple Instruments, etc., etc.
 Hundreds of Recipes for every variety of Industrial
 Work.

DEPARTMENT OF THE FARM.

How to construct Farm Buildings. The Dairy. Hints
 for care of Stock, about Manures, Plants, Vegetables,
 Trees, Farm Machinery, etc., etc.

DEPARTMENT OF THE HOUSEHOLD.

Cleaning Processes of all kinds. Window Gardens.
 Destruction of Vermin. Care of China, Glass, and Fur-
 niture. Papering Walls. Simple Remedies, etc., etc.
 The volume comprises 250 pages, is printed on fine
 paper, with gilt edges, and is of large pocket-book form,
 flexible covers, neatly ornamented.

Mailed, post paid, on receipt of \$1.50.

1 copy Scientific American, 1 year, and 1 copy

Wrinkles and Recipes.....\$4.20

Address

H. N. MUNN,

PUBLISHER,

P. O. BOX 774,

37 Park Row, New York City.

HARTFORD

STEAM BOILER

Inspection & Insurance

COMPANY.

W. E. FRANKLIN, V. P. L. J. M. ALLEN, Pres't.
 J. B. FRENCH, Sec.
 HARTFORD, CONN.

GLASS OIL CUPS

of all kinds. Brass Fittings for Steam, Water and Gas.
 Brass Castings. Send for Catalogue.
 HILLARD & HOLLAND 62 Gold St., New York.

THE NATIONAL

Steel Tube Cleaner.

Adopted and in use by U. S. Navy. For sale by dealers.
 Send for Circular. THE CHALMERS SPENCE CO.,
 foot E. 9th Street, N. Y., Agents for the U. S.

NON-COMBUSTIBLE STEAM BOILER & PIPE COVERING

WITH AIR SPACE IMPROVEMENT.
 Saves 10 to 20 per cent. CHALMERS SPENCE CO.,
 foot E. 9th St., N. Y.; 1292 N. 2nd St., St. Louis, Mo.

THE ADVERTISER WANTS TO PROCURE
 a Stationary STEAM FIRE PUMP. Among its good
 qualities it must, 1st, be able to draft water through a
 12 inch suction, having a perpendicular rise of 20 ft.,
 without any previous priming; 2d, while so drafting wa-
 ter, throw six streams, at least, through 1 1/2 inch noz-
 zles, maintaining 100 lbs. water pressure and using steam
 at 60 to 70 lbs. Any one having such a pump (new) may
 find a cash customer by sending description and price to
 G. T. CO., P. O. Box 778, N. Y. City.

Diamond Solid Emery Wheels.

PRICES—4x4, \$1.25; 4x4 1/2, \$1.35; 4x5, \$1.45; 4x5 1/2, \$1.55; 4x6, \$1.65; 4x6 1/2, \$1.75; 4x7, \$1.85; 4x7 1/2, \$1.95; 4x8, \$2.05; 4x8 1/2, \$2.15; 4x9, \$2.25; 4x9 1/2, \$2.35; 4x10, \$2.45; 4x10 1/2, \$2.55; 4x11, \$2.65; 4x11 1/2, \$2.75; 4x12, \$2.85; 4x12 1/2, \$2.95; 4x13, \$3.05; 4x13 1/2, \$3.15; 4x14, \$3.25; 4x14 1/2, \$3.35; 4x15, \$3.45; 4x15 1/2, \$3.55; 4x16, \$3.65; 4x16 1/2, \$3.75; 4x17, \$3.85; 4x17 1/2, \$3.95; 4x18, \$4.05; 4x18 1/2, \$4.15; 4x19, \$4.25; 4x19 1/2, \$4.35; 4x20, \$4.45; 4x20 1/2, \$4.55; 4x21, \$4.65; 4x21 1/2, \$4.75; 4x22, \$4.85; 4x22 1/2, \$4.95; 4x23, \$5.05; 4x23 1/2, \$5.15; 4x24, \$5.25; 4x24 1/2, \$5.35; 4x25, \$5.45; 4x25 1/2, \$5.55; 4x26, \$5.65; 4x26 1/2, \$5.75; 4x27, \$5.85; 4x27 1/2, \$5.95; 4x28, \$6.05; 4x28 1/2, \$6.15; 4x29, \$6.25; 4x29 1/2, \$6.35; 4x30, \$6.45; 4x30 1/2, \$6.55; 4x31, \$6.65; 4x31 1/2, \$6.75; 4x32, \$6.85; 4x32 1/2, \$6.95; 4x33, \$7.05; 4x33 1/2, \$7.15; 4x34, \$7.25; 4x34 1/2, \$7.35; 4x35, \$7.45; 4x35 1/2, \$7.55; 4x36, \$7.65; 4x36 1/2, \$7.75; 4x37, \$7.85; 4x37 1/2, \$7.95; 4x38, \$8.05; 4x38 1/2, \$8.15; 4x39, \$8.25; 4x39 1/2, \$8.35; 4x40, \$8.45; 4x40 1/2, \$8.55; 4x41, \$8.65; 4x41 1/2, \$8.75; 4x42, \$8.85; 4x42 1/2, \$8.95; 4x43, \$9.05; 4x43 1/2, \$9.15; 4x44, \$9.25; 4x44 1/2, \$9.35; 4x45, \$9.45; 4x45 1/2, \$9.55; 4x46, \$9.65; 4x46 1/2, \$9.75; 4x47, \$9.85; 4x47 1/2, \$9.95; 4x48, \$10.05; 4x48 1/2, \$10.15; 4x49, \$10.25; 4x49 1/2, \$10.35; 4x50, \$10.45; 4x50 1/2, \$10.55; 4x51, \$10.65; 4x51 1/2, \$10.75; 4x52, \$10.85; 4x52 1/2, \$10.95; 4x53, \$11.05; 4x53 1/2, \$11.15; 4x54, \$11.25; 4x54 1/2, \$11.35; 4x55, \$11.45; 4x55 1/2, \$11.55; 4x56, \$11.65; 4x56 1/2, \$11.75; 4x57, \$11.85; 4x57 1/2, \$11.95; 4x58, \$12.05; 4x58 1/2, \$12.15; 4x59, \$12.25; 4x59 1/2, \$12.35; 4x60, \$12.45; 4x60 1/2, \$12.55; 4x61, \$12.65; 4x61 1/2, \$12.75; 4x62, \$12.85; 4x62 1/2, \$12.95; 4x63, \$13.05; 4x63 1/2, \$13.15; 4x64, \$13.25; 4x64 1/2, \$13.35; 4x65, \$13.45; 4x65 1/2, \$13.55; 4x66, \$13.65; 4x66 1/2, \$13.75; 4x67, \$13.85; 4x67 1/2, \$13.95; 4x68, \$14.05; 4x68 1/2, \$14.15; 4x69, \$14.25; 4x69 1/2, \$14.35; 4x70, \$14.45; 4x70 1/2, \$14.55; 4x71, \$14.65; 4x71 1/2, \$14.75; 4x72, \$14.85; 4x72 1/2, \$14.95; 4x73, \$15.05; 4x73 1/2, \$15.15; 4x74, \$15.25; 4x74 1/2, \$15.35; 4x75, \$15.45; 4x75 1/2, \$15.55; 4x76, \$15.65; 4x76 1/2, \$15.75; 4x77, \$15.85; 4x77 1/2, \$15.95; 4x78, \$16.05; 4x78 1/2, \$16.15; 4x79, \$16.25; 4x79 1/2, \$16.35; 4x80, \$16.45; 4x80 1/2, \$16.55; 4x81, \$16.65; 4x81 1/2, \$16.75; 4x82, \$16.85; 4x82 1/2, \$16.95; 4x83, \$17.05; 4x83 1/2, \$17.15; 4x84, \$17.25; 4x84 1/2, \$17.35; 4x85, \$17.45; 4x85 1/2, \$17.55; 4x86, \$17.65; 4x86 1/2, \$17.75; 4x87, \$17.85; 4x87 1/2, \$17.95; 4x88, \$18.05; 4x88 1/2, \$18.15; 4x89, \$18.25; 4x89 1/2, \$18.35; 4x90, \$18.45; 4x90 1/2, \$18.55; 4x91, \$18.65; 4x91 1/2, \$18.75; 4x92, \$18.85; 4x92 1/2, \$18.95; 4x93, \$19.05; 4x93 1/2, \$19.15; 4x94, \$19.25; 4x94 1/2, \$19.35; 4x95, \$19.45; 4x95 1/2, \$19.55; 4x96, \$19.65; 4x96 1/2, \$19.75; 4x97, \$19.85; 4x97 1/2, \$19.95; 4x98, \$20.05; 4x98 1/2, \$20.15; 4x99, \$20.25; 4x99 1/2, \$20.35; 4x100, \$20.45; 4x100 1/2, \$20.55; 4x101, \$20.65; 4x101 1/2, \$20.75; 4x102, \$20.85; 4x102 1/2, \$20.95; 4x103, \$21.05; 4x103 1/2, \$21.15; 4x104, \$21.25; 4x104 1/2, \$21.35; 4x105, \$21.45; 4x105 1/2, \$21.55; 4x106, \$21.65; 4x106 1/2, \$21.75; 4x107, \$21.85; 4x107 1/2, \$21.95; 4x108, \$22.05; 4x108 1/2, \$22.15; 4x109, \$22.25; 4x109 1/2, \$22.35; 4x110, \$22.45; 4x110 1/2, \$22.55; 4x111, \$22.65; 4x111 1/2, \$22.75; 4x112, \$22.85; 4x112 1/2, \$22.95; 4x113, \$23.05; 4x113 1/2, \$23.15; 4x114, \$23.25; 4x114 1/2, \$23.35; 4x115, \$23.45; 4x115 1/2, \$23.55; 4x116, \$23.65; 4x116 1/2, \$23.75; 4x117, \$23.85; 4x117 1/2, \$23.95; 4x118, \$24.05; 4x118 1/2, \$24.15; 4x119, \$24.25; 4x119 1/2, \$24.35; 4x120, \$24.45; 4x120 1/2, \$24.55; 4x121, \$24.65; 4x121 1/2, \$24.75; 4x122, \$24.85; 4x122 1/2, \$24.95; 4x123, \$25.05; 4x123 1/2, \$25.15; 4x124, \$25.25; 4x124 1/2, \$25.35; 4x125, \$25.45; 4x125 1/2, \$25.55; 4x126, \$25.65; 4x126 1/2, \$25.75; 4x127, \$25.85; 4x127 1/2, \$25.95; 4x128, \$26.05; 4x128 1/2, \$26.15; 4x129, \$26.25; 4x129 1/2, \$26.35; 4x130, \$26.45; 4x130 1/2, \$26.55; 4x131, \$26.65; 4x131 1/2, \$26.75; 4x132, \$26.85; 4x132 1/2, \$26.95; 4x133, \$27.05; 4x133 1/2, \$27.15; 4x134, \$27.25; 4x134 1/2, \$27.35; 4x135, \$27.45; 4x135 1/2, \$27.55; 4x136, \$27.65; 4x136 1/2, \$27.75; 4x137, \$27.85; 4x137 1/2, \$27.95; 4x138, \$28.05; 4x138 1/2, \$28.15; 4x139, \$28.25; 4x139 1/2, \$28.35; 4x140, \$28.45; 4x140 1/2, \$28.55; 4x141, \$28.65; 4x141 1/2, \$28.75; 4x142, \$28.85; 4x142 1/2, \$28.95; 4x143, \$29.05; 4x143 1/2, \$29.15; 4x144, \$29.25; 4x144 1/2, \$29.35; 4x145, \$29.45; 4x145 1/2, \$29.55; 4x146, \$29.65; 4x146 1/2, \$29.75; 4x147, \$29.85; 4x147 1/2, \$29.95; 4x148, \$30.05; 4x148 1/2, \$30.15; 4x149, \$30.25; 4x149 1/2, \$30.35; 4x150, \$30.45; 4x150 1/2, \$30.55; 4x151, \$30.65; 4x151 1/2, \$30.75; 4x152, \$30.85; 4x152 1/2, \$30.95; 4x153, \$31.05; 4x153 1/2, \$31.15; 4x154, \$31.25; 4x154 1/2, \$31.35; 4x155, \$31.45; 4x155 1/2, \$31.55; 4x156, \$31.65; 4x156 1/2, \$31.75; 4x157, \$31.85; 4x157 1/2, \$31.95; 4x158, \$32.05; 4x158 1/2, \$32.15; 4x159, \$32.25; 4x159 1/2, \$32.35; 4x160, \$32.45; 4x160 1/2, \$32.55; 4x161, \$32.65; 4x161 1/2, \$32.75; 4x162, \$32.85; 4x162 1/2, \$32.95; 4x163, \$33.05; 4x163 1/2, \$33.15; 4x164, \$33.25; 4x164 1/2, \$33.35; 4x165, \$33.45; 4x165 1/2, \$33.55; 4x166, \$33.65; 4x166 1/2, \$33.75; 4x167, \$33.85; 4x167 1/2, \$33.95; 4x168, \$34.05; 4x168 1/2, \$34.15; 4x169, \$34.25; 4x169 1/2, \$34.35; 4x170, \$34.45; 4x170 1/2, \$34.55; 4x171, \$34.65; 4x171 1/2, \$34.75; 4x172, \$34.85; 4x172 1/2, \$34.95; 4x173, \$35.05; 4x173 1/2, \$35.15; 4x174, \$35.25; 4x174 1/2, \$35.35; 4x175, \$35.45; 4x175 1/2, \$35.55; 4x176, \$35.65; 4x176 1/2, \$35.75; 4x177, \$35.85; 4x177 1/2, \$35.95; 4x178, \$36.05; 4x178 1/2, \$36.15; 4x179, \$36.25; 4x179 1/2, \$36.35; 4x180, \$36.45; 4x180 1/2, \$36.55; 4x181, \$36.65; 4x181 1/2, \$36.75; 4x182, \$36.85; 4x182 1/2, \$36.95; 4x183, \$37.05; 4x183 1/2, \$37.15; 4x184, \$37.25; 4x184 1/2, \$37.35; 4x185, \$37.45; 4x185 1/2, \$37.55; 4x186, \$37.65; 4x186 1/2, \$37.75; 4x187, \$37.85; 4x187 1/2, \$37.95; 4x188, \$38.05; 4x188 1/2, \$38.15; 4x189, \$38.25; 4x189 1/2, \$38.35; 4x190, \$38.45; 4x190 1/2, \$38.55; 4x191, \$38.65; 4x191 1/2, \$38.75; 4x192, \$38.85; 4x192 1/2, \$38.95; 4x193, \$39.05; 4x193 1/2, \$39.15; 4x194, \$39.25; 4x194 1/2, \$39.35; 4x195, \$39.45; 4x195 1/2, \$39.55; 4x196, \$39.65; 4x196 1/2, \$39.75; 4x197, \$39.85; 4x197 1/2, \$39.95; 4x198, \$40.05; 4x198 1/2, \$40.15; 4x199, \$40.25; 4x199 1/2, \$40.35; 4x200, \$40.45; 4x200 1/2, \$40.55; 4x201, \$40.65; 4x201 1/2, \$40.75; 4x202, \$40.85; 4x202 1/2, \$40.95; 4x203, \$41.05; 4x203 1/2, \$41.15; 4x204, \$41.25; 4x204 1/2, \$41.35; 4x205, \$41.45; 4x205 1/2, \$41.55; 4x206, \$41.65; 4x206 1/2, \$41.75; 4x207, \$41.85; 4x207 1/2, \$41.95; 4x208, \$42.05; 4x208 1/2, \$42.15; 4x209, \$42.25; 4x209 1/2, \$42.35; 4x210, \$42.45; 4x210 1/2, \$42.55; 4x211, \$42.65; 4x211 1/2, \$42.75; 4x212, \$42.85; 4x212 1/2, \$42.95; 4x213, \$43.05; 4x213 1/2, \$43.15; 4x214, \$43.25; 4x214 1/2, \$43.35; 4x215, \$43.45; 4x215 1/2, \$43.55; 4x216, \$43.65; 4x216 1/2, \$43.75; 4x217, \$43.85; 4x217 1/2, \$43.95; 4x218, \$44.05; 4x218 1/2, \$44.15; 4x219, \$44.25; 4x219 1/2, \$44.35; 4x220, \$44.45; 4x220 1/2, \$44.55; 4x221, \$44.

SCIENTIFIC AMERICAN

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

Vol. XXXIII.—No. 22.
(NEW SERIES.)

NEW YORK, NOVEMBER 27, 1875.

\$3.20 per Annum
(POSTAGE PREPAID.)

NEW SYSTEM FOR VENTILATING AND CLEANSING DRAIN PIPES IN BUILDINGS.

We illustrated, not long ago, a new form of floodway for buildings, intended to drain off water from floors deluged either through leaks in the supply pipes or through the means adopted for extinguishing fires, and so to prevent injury by water to other portions of the edifice. The inventor of this ingenious device, Mr. John H. Morrell, of New York city, has lately patented, through the Scientific American Patent Agency, another invention of equal and perhaps greater utility, and one which will commend itself to all who appreciate the necessity of an economical supply of water and the complete prevention of the escape of noxious sewer gases from the drains and sinks of a dwelling. The danger of these foul emanations, carrying as they do the germs of typhoid and diphtheria, cannot be too forcibly impressed upon the public; and since of late numerous severe cases of disease, directly traceable to the miasma, have been prominently brought to general notice, inventions tending to improve the sanitary arrangements of residences possess a present and timely interest.

Mr. Morrell's device, of which we give engravings in detail herewith, involves arrangements both for ventilating and for cleansing the sinks. By means of a reservoir, from which distributing pipes lead to the various receptacles, the rain water which falls on the roof is collected and conducted to the various traps or closets, or water may be supplied to said reservoir by a pump or any other convenient means. Utilizing the rain water, however, is mentioned here in advance, because such employment virtually renders the apparatus automatic. That is to say, supposing the house to be closed and empty, the system of pipes will serve as ventilators; and when a fall of rain occurs, they will then serve to fill the traps, thus supplying the water evaporated from the latter, and, besides, washing them out, so that the very frequent occurrence, of an unoccupied house becoming filled with foul gases from its drains receiving no attention, is thus rendered practically impossible. There are various other advantages of Mr. Morrell's plan, which will be found noted in proper place in the following description.

The large pipe, A, Fig. 1, is the sewer conduit, which it is proposed to lead up through the roof, and to provide with an open top and cap above, for ventilation of its interior. B is a reservoir, which receives water from the roof or from the pipe, C, connected with a suitable pump on a lower story. In Fig. 1 the mouth of the tube which connects the reservoir with the roof is shown covered by a cap and grating. In case this opening is frequently liable to be obstructed by snow and ice, another arrangement, shown in Fig. 2, which exhibits the reservoir and its parts on a larger scale, is employed. The supply pipe, C, would be used for water, and ventilation gained by the curved tube, D, in connection with a register cover. It will be observed that this tube, D, is made of sufficient size and height not to be impeded by ordinary deposits of snow or ice, and that it is always open for ventilation, whether the register cover be

open or not. But as a security against the obstruction of the register, the inventor proposes to use a double walled box or hood, placed above the register, as in Fig. 8. The warm air which collects within the hood, directly above the register, will always keep the latter free from ice or snow. The water supply pipe, C, has a check valve to prevent back flow of water or gas. At E, in the reservoir, is attached a pipe for carrying off the water to any portion of the building where it may be needed. F is the overflow pipe, so arranged as to conduct off all water which rises above its orifice in the reservoir, directly to the trap of a water closet, in manner shown by

adding still another and important advantage. To facilitate the ventilation of the system during the down flow of the water, the curved roof pipe, in Fig. 2, is extended, as shown at J, through the interior of pipe, F. At convenient points, openings are made in it for the upward escape of the gases. It may also extend down through other pipes and chambers, eventually connecting with the sewer pipes; and it may also be led to the traps, as shown in Figs. 2 and 3. The same arrangement of inner and outer pipe may be carried to a water closet basin, as represented in Fig. 5, so as to ventilate the same. Instead of using double pipes, a single pipe may be employed, having a partition, as in Fig. 4, one side being for ventilation and the other for a water conduit. Fig. 6 shows the application of the double pipes to distributing pipes and branches, a rise, K, being formed just at the points of junction, in order to divide the water equally into each branch. Fig. 7 represents the application of the double pipe to urinals. In Fig. 1 is also illustrated the floodway drain referred to in the initial paragraph. L is the sunken receptacle, beneath the floor and covered with a grating. In this the water collects, and then, by the inclined pipe, at M, escapes into the sewer pipe.

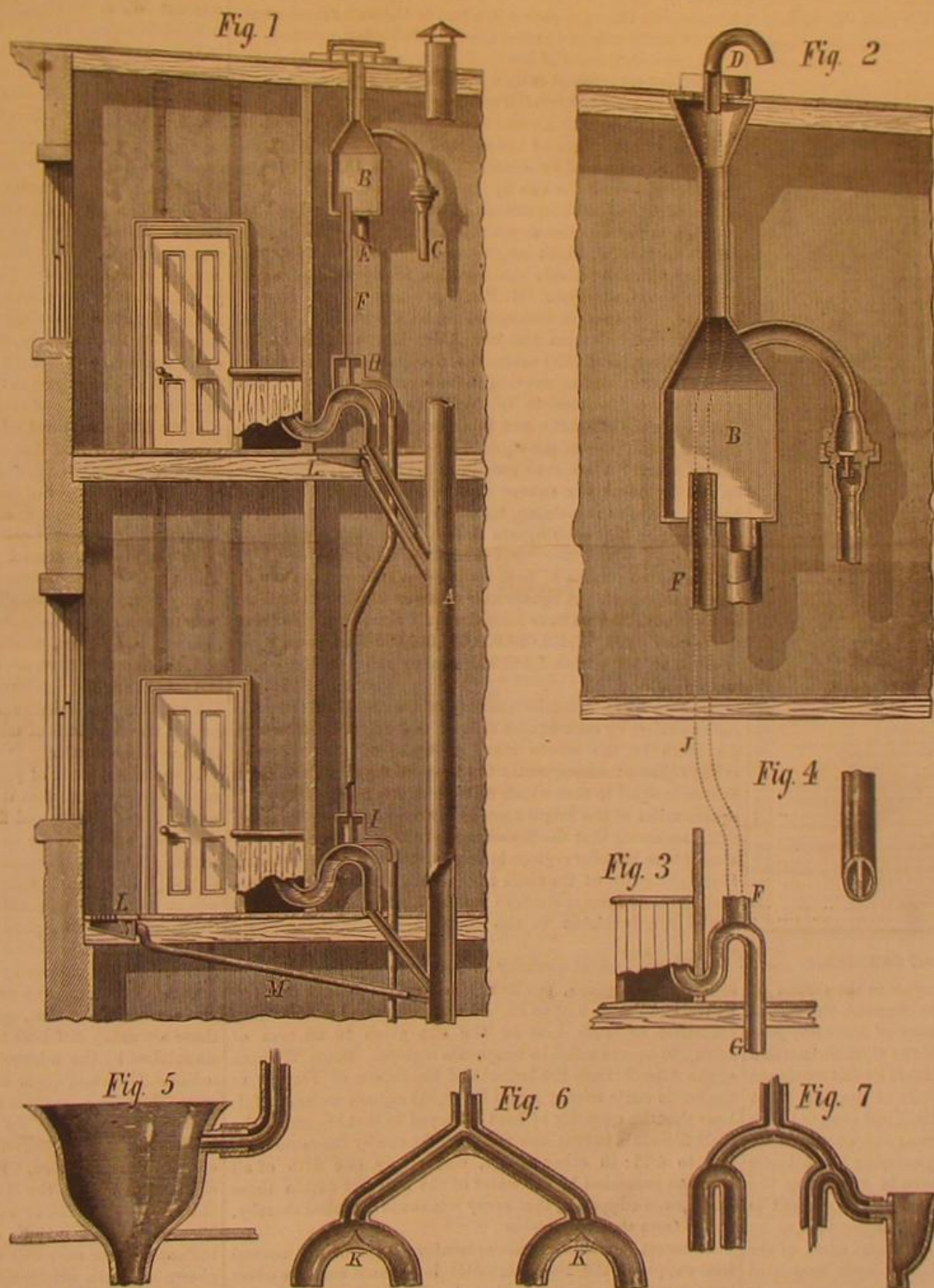
For further information address or apply to the inventor, 475 Fourth avenue, corner 32d street, New York city, where a person will be ready to show the entire invention, now in full operation, in a building near by.

A Physiological Problem.

A rather curious problem for physiologists is engendered by experiments recently tried by M. Ponchet upon a puppy. It is the general opinion that the brain of an infant, when the eyes are first used, or that of a person born blind and afterward restored to sight, is unable to translate correctly the impressions conveyed from the retina by the optic nerve. The individual has no idea, it is asserted, of relative distances, nor of the relative physical characteristics of bodies, but only learns the same through practice, and therefore it is to be expected that the sudden restoration of sight will result in a kind of optical confusion, which is only reduced to order after lapse of time. M. Ponchet's experiment, however, seems to negative all this, so far as the use of one eye is concerned; that is to say, if a person, blind in one eye, regains sight therein, and at the same time loses vision in the former perfect organ, the new-

ly acquired sight is exactly as good as that lost, and the new eye requires no education whatever. The eyelids of one eye of a puppy, immediately after birth, were surgically treated so as to cause them to grow together, completely of course shutting off vision from the organ. The animal as it grew used but the single eye until it was four months old, when the good eye was similarly closed and the eyelids of the other opened. Although the left eye had never been used, and although it served as the sole means of sight, not the slightest difference could be detected in the actions of the animal. It recognized objects or avoided obstacles with perfect facility, and, in brief, the most careful examination failed to prove that the dog experienced any different sensations from those to which it had become accustomed.

The subject is interesting in view of the theory which already exists of there being corresponding points in both retinas, from which vibrations are transmitted to the brain.



MORRELL'S SYSTEM OF VENTILATION AND CLEANSING DRAIN PIPES.

the dotted lines connecting Figs. 2 and 3; so that the water, after filling the trap, passes off by the pipe, G, to the sewer. Instead of leading the pipe directly to the trap, it may, as in Fig. 1, connect with a receiver, H, which contains a partition so arranged that water, entering from F, will be divided, one portion passing to the trap and thence to the sewer pipe, and the other running through another pipe to another receiver, I, Fig. 1, there to be again divided and led to other traps, and so on to as many sinks as may be desired. The above described arrangement is such that, in addition to cleansing the traps whenever there is a down flow of water, the system, when its pipes are empty, offers through the latter a free exit for foul gases, so that the fourfold advantage is gained of a storage reservoir, a distributing reservoir for water, a water closet trap supply and pipe cleaner, and a ventilating apparatus. As we have already pointed out, the action is automatic, and therefore no care or attention is necessary, thus

Scientific American.

MUNN & CO., Editors and Proprietors.

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

O. D. MUNN.

A. E. BEACH.

TERMS.

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

Club Rates.

Ten copies, one year, each \$2 70, postage included.....\$27 00
Over ten copies, same rate each, postage included..... 2 70

By the new law, postage is payable in advance by the publishers, and the subscriber then receives the paper free of charge.

NOTE.—Persons subscribing will please to give their full names, and Post Office and State address, plainly written, and also state at which time they wish their subscriptions to commence, otherwise the paper will be sent from the receipt of the order. When requested, the numbers can be supplied from January 1st, when the volume commenced. In case of changing residence, state former address, as well as give the new one. No changes can be made unless the former address is given.

VOLUME XXXIII., No. 22. [NEW SERIES.] Thirtieth Year.

NEW YORK, SATURDAY, NOVEMBER 27, 1875.

Contents.

(Illustrated articles are marked with an asterisk.)

Air, nitrogen and oxygen in.....	341
Alum, crystallizing (36).....	341
American Institute Fair, the.....	341
Aniline red on leather (71).....	341
Answers to correspondents.....	341
Antelopes.....	341
Bal, a falling (75).....	341
Battery difficulty, a (43).....	341
Battery, ignition by (41).....	341
Battery, magnetic (46).....	341
Black metal, flux for (12).....	341
Boils, strain on.....	341
Black dyes (54).....	341
Boiler brickwork.....	341
Boilers, bolts and castings for.....	341
Boilers, pressure in (29).....	341
Boilers, setting.....	341
Boilers, small (59).....	341
Boiler tubes, iron (61).....	341
Room, joining logs in a (7).....	341
Boring bars, eccentric (69).....	341
Brake trials, high speed.....	341
Bricks, red (57).....	341
Buckskin gloves, cleaning (53).....	341
Burial vault, building a (25).....	341
Business and personal.....	341
Capping machine, a.....	341
Car seat, auxiliary.....	341
Cement for gutta serena (38).....	341
Cereals and their chemical value.....	341
Cresapol, a new.....	341
Chalk, liquid (24).....	341
Chimney, the.....	341
Chromatope, a new.....	341
Cleaning cloths and yarns.....	341
Clinker, removing (60).....	341
Cobwebs, utilizing.....	341
Copper walls, colorless (29).....	341
Cores for casting (67).....	341
Corn-fed hens.....	341
Dies, copper counter (9).....	341
Donkey street cars.....	341
Dreaming (51).....	341
Drive well, the patent.....	341
Eccentric gearing (71).....	341
Economy in use, etc.....	341
Electricity, heat from (42).....	341
Electro-plating, blisters in (49).....	341
Engineer's certificate, an (64).....	341
Engineer's studies, an (51).....	341
Engine, lead on an (63).....	341
Engines for boats (5).....	341
Engines, speed of (30).....	341
Engine, thumping in an (11).....	341
Engine, water in an (13).....	341
Fermentation, inorganic.....	341
Fork scribers.....	341
"Furnaces for sawdust".....	341
Gases under pressure (55).....	341
Gas from dead animals, etc.....	341
Gas from oil, etc. (36).....	341
Gold from waste, extracting (70).....	341
Gulf Stream as a heat carrier.....	341
Guns, the 81-ton, eclipsed.....	341
Gymnasium, a pocket.....	341
Hair, etc., ammonia from (15).....	341
Honeycombs, artificial.....	341
Horse power (1).....	341
Induction coil, a new.....	341
Injection of nutritive substances.....	341
Inventions patented in England.....	341
Iron mines, hematite, in England.....	341
Japanning iron (51).....	341
Kerosene barrels, cleaning (53).....	341
Lathe, hand and slide.....	341
Lighting, floating.....	341
Lighting rods, etc. (48).....	341
Lining or marking out.....	341
Magnetism in a relay (44).....	341
Magnetism, permanent (47).....	341
Mats, Makarov's.....	341
Mercurial ointment (54).....	341
Naphtha, cleansing goods by.....	341
Nickelization.....	341
Oil for slate paint (41).....	341
Oil from leather (11).....	341
Jades of lead, iron, etc. (35).....	341
Oxygen not inflammable (21).....	341
Paint for steam pipes (58).....	341
Patent decisions, recent.....	341
Patented, a lost art.....	341
Patents, American and foreign.....	341
Patents, French.....	341
Patents, list of Canadian.....	341
Patents, official list of.....	341
Pens, dotting.....	341
Physiological problem, a.....	341
Pin, a new.....	341
Polishing steel (67).....	341
Pontons, pneumatic.....	341
Port wine, adulteration of.....	341
Posts, to make durable (6).....	341
Practical mechanism—No. 36.....	341
Railway speeds (23).....	341
Recoil of guns (35).....	341
Rosin, purifying (28).....	341
Salt.....	341
Salt for domestic animals.....	341
Salt in sea water (9).....	341
Salt on a brick wall (13).....	341
Sambur, the.....	341
Sand, pumping (62).....	341
Saros, the (9).....	341
Shells, dissolving (19).....	341
Shingles, durable.....	341
Ships, model (9).....	341
Silvering glass.....	341
Skylights, glass in (4).....	341
Spectral lines and atomic weights.....	341
Steam ports, engine (65).....	341
Stream line theory, the (20).....	341
Strychnine, poisoning by.....	341
Telegraphs in France, domestic.....	341
Tellurium in China.....	341
Trees, inclination of (40).....	341
Tunnel at Rio de Janeiro.....	341
Turpentine, the smell of (26).....	341
Valve, engine, handworked (28).....	341
Varnish for electromagnets (50).....	341
Ventilating and cleaning pipes.....	341
Wagner Free Institute, the.....	341
Water, filtering (27).....	341
Water on a stove (37).....	341
Water wheels, constructing (32).....	341
Water wheels, speed of (1).....	341
Water, when fit to drink.....	341
Wax for store patterns (66).....	341
Wells, tubing for (16).....	341
Wheel question (11).....	341
Wool mineral.....	341

THE GULF STREAM AS A HEAT CARRIER.

The Gulf Stream finds a sturdy champion in the author of "Climate and Time," Mr. Croll, of the Scottish Geological Survey. Dr. Carpenter, who has a theory of his own, goes out of his way to belittle the influence of the Gulf Stream as a modifier of climate, calling the stream a mere rivulet compared with the (theoretically) grand surface drift of tropical water into the North Atlantic: whereupon Mr. Croll resorts to the logic of fact and figures, and demonstrates the enormous influence which the body of warm water, entering the Atlantic through the Straits of Florida, must have in mitigating the climate along its subsequent path. Mr. Croll's argument is presented at great length, proving beyond a doubt that, so far from being currently overestimated, the thermal effect of the Gulf Stream is vastly greater than has ever been suspected hitherto.

The observations of the United States Coast Survey, in regard to the breadth, depth, and temperature of the stream were many and careful. Unfortunately, however, no observations were made to determine precisely the velocity of the current at all depths along any particular section; consequently, while the mean temperature of the stream may be determined with considerable precision, it is impossible to make an accurate estimate of the volume of the current. From the limited data afforded by the records of the survey, Maury considered the volume of the stream to be equal to that of a stream 32 miles wide and 1,200 feet deep, flowing at the rate of five knots an hour. That would give a flow of 6,165,700,000,000 cubic feet an hour. In his "Physical Geography," Sir John Herschel estimates it as equal to a stream 30 miles wide and 2,200 feet deep, flowing at the rate of four miles an hour, that is, having a volume of 7,359,900,000,000 cubic feet an hour. More recently Dr. Colding estimated its volume at 5,760,000,000,000 cubic feet an hour. From the same data, Mr. Croll, some years ago, determined its volume

to be equal to that of a stream 50 miles wide and 1,000 feet deep, flowing at the rate of four miles an hour, or considerably less than the lowest of the foregoing estimates. To obviate any possible objection on the ground of overestimating the volume of the stream, Mr. Croll calculates its heating capacity on the basis of a velocity of only two miles an hour, according to which the flow would be 2,787,840,000,000 cubic feet an hour, a little over one third of Herschel's estimate.

The average temperature of the surface water in the Florida Channel, for the whole year, is 80°. The bottom temperature, according to Dr. Carpenter, is 60°, which would make the mean temperature about 75°. Mr. Croll thinks this estimate much too high, an error arising from an underestimation of the sectional area of the stream. Believing that the current extends to a depth where the temperature is below 60°, he calculates that the mean temperature of the stream is not over 65°. In its passage to the arctic regions, the water is cooled down to about 30°. Assuming that part of the return current, by the way of the Azores, is fed from the water of the Gulf Stream proper (not entirely from the larger current further east, discovered by the Challenger expedition, and considered by Captain Nares to be an offshoot of the Gulf Stream), a considerable portion of the stream is not cooled below 45°. Altogether, however, Mr. Croll thinks he cannot be overestimating the cooling of the water in fixing the average minimum temperature at 40°, thus allowing for the loss of 25° of heat while the water is making its northern journey. At this rate each cubic foot of the water must transport from the tropics to more northern latitudes upwards of 1,158,300 foot pounds of heat. Consequently the total quantity of heat transferred daily by the entire stream amounts to 77,479,650,000,000,000 foot pounds.

The effect which this vast amount of heat must have in mitigating the climate of the regions to which it is carried can best be estimated by comparing it with the amount of heat received from the sun by the same areas.

According to the observations of Sir John Herschel and M. Pouillet, the sun pours down upon every square foot of the earth's surface at right angles to its rays about 83 foot pounds of heat a second: this allowing for no absorption of heat by the atmosphere. M. Pouillet estimated the loss of heat by atmospheric absorption to be 24 per cent of the amount received from the sun. Mr. Meech (*Smithsonian Contributions*, Vol. IX) estimates the loss at 23 per cent. At the latter rate of absorption there would remain 64.75 foot pounds of heat a second to fall on each square foot of the earth's surface when the sun is directly overhead. On the equator at the time of the equinoxes, the sun shines daily for twelve hours. Were it to remain at the zenith all this time, its heating effect per square foot would be 2,796,768 foot pounds. Not so remaining, its effect is less in the ratio of 1 to 1.5708; so that each square foot of the earth's surface at the equator, under the most favorable conditions, receives 1,780,474 foot pounds of heat during the twelve hours from sunrise to sunset. A square mile receives 49,636,750,000,000 foot pounds. As we have seen, the Gulf Stream carries from the tropics daily 77,479,650,000,000,000 foot pounds, or as much as falls upon 1,560,936 square miles at the equator.

Mr. Meech estimates the quantity of heat received from the sun annually, by each square mile of the frigid zone, taking the mean of the whole zone, at 0.454 of that received at the equator: consequently the heat conveyed by the Gulf Stream is equal to that which falls on an average of 3,436,900 square miles of the frigid zone, or nearly $\frac{2}{3}$ of its entire area: this, assuming that the percentage of heat absorbed by the atmosphere in polar regions is no greater than at the equator. If the obliquity of the sun's rays is allowed for, it appears that the Gulf Stream conveys not far from half as much heat as the sun furnishes to the entire area within the arctic circle.

The mean annual quantity of heat received from the sun in temperate regions, per unit of surface, is to that received by the equator as 9.08 to 12. Consequently the Gulf Stream furnishes as much heat as the sun gives to an area of 2,062,960 square miles in temperate regions. Since the area of the Atlantic from the latitude of the Straits of Florida to the arctic circle is only about 8,500,000 square miles, it follows that the quantity of heat conveyed to that region by the Gulf Stream is to that received from the sun by the same area, as 1 to 4.12: in other words, very nearly one fifth of all the heat possessed by the water of the Atlantic within those limits, even supposing that every sun ray is absorbed thereby, comes from the Gulf Stream.

To assert that this enormous reinforcement of the normal heat supply of the North Atlantic is without sensible effect upon its climate is simply absurd. To Mr. Findlay's assertions that the inability of the Gulf Stream to affect the climate of England is self-evident and needs no calculations, Mr. Croll retorts with calculations from Mr. Findlay's own data, most effectively disproving his rash assertions. Mr. Findlay says, for instance, that all the water passing through the Florida channel will not make a layer of water more than six inches thick a day over the space which the stream is supposed to cover off the coast of England. Mr. Croll replies that a layer of water six inches thick, cooling 25°, will give out 579,000 foot pounds of heat per square foot. The amount of heat received from the sun in the mean latitude of Great Britain, 55°, taking the mean of the sun's heat for the entire year, is 1,047,730 foot pounds per square foot a day. Consequently Mr. Findlay's layer of water must give out an amount of heat equal to more than one half of all that is received from the sun. But assuming that the stream should leave the half of its heat on the American shores, and carry to the shores of Britain only 12½° of heat, there would still remain a heating power of 289,500 foot pounds per square foot,

or more than a fourth as much as the sun supplies in that latitude.

THE PATENT DRIVE WELL.

This consists of a small tube driven into the ground by means of a hammer, until water is reached. A pump is then applied to the tube, and the well is complete. It is the invention of Colonel Nelson W. Green, of Courtlandt, N. Y., patented by him May 9, 1871, but discovered and put into use by him in 1861 while he was serving in the United States army. It has been brought into use all over the world, and is one of the most valuable of inventions. Nearly all the dwellings at the famous watering place of Oak Bluffs, Martha's Vineyard, are supplied by this means with water, including the Sea View Hotel. At the latter establishment a six inch pipe is driven down 22 feet into the ground; and such is the abundance of the supply that a steam pump of equal bore, running constantly for eighteen hours out of twenty-four, never lacks water, which is pure and excellent. There appears to be a fresh water lake or stratum under the whole island, at about the above depth. When the drive well tube is sunk to 27 feet, it strikes salt water. If the well tube is sunk in the salt-water-covered bottom, a few rods out from the shore, the result is the same; fresh water is found at about 22 feet, and salt water at about 27 feet. The drive well patent has been a subject of litigation for several years. The owners are at present conducting an important litigation against W. & B. Douglas, of Middletown, Conn., who are alleged to be infringers. Nearly a year has been occupied in taking testimony, which reaches three thousand pages of foolscap, while the costs so far are estimated at upwards of a hundred thousand dollars. The case is before the United States Circuit Court, Brooklyn, Judge Benedict presiding.

CEREALS AND THEIR CHEMICAL VALUE.

Wheat, oats, rye, barley, and Indian corn are cereals which yield to men all the principles which build up the human frame. Some other plants make fat-forming matter; some merely afford acids, which assist the digestion of food. Among the latter are the various fruits, particularly the grape, so much recommended to the invalid, the acid of the grape being the active agent. But in wheat and its companions of the field, namely, oats, barley, and rye, we meet with every substance necessary for the staff of human life. We will first glance briefly at the constituents of the cereals, and ascertain something of their properties.

If we take a grain of wheat or other cereal, and burn it in a gas flame, we find that only a portion of it is consumable. The unconsumable portion that remains is termed the ash, which is the mineral or inorganic portion. The consumable portion is the organic or combustible compound of vegetable matter, the proportion being 94 per cent of principally vegetable matter, and from 1 to 6 per cent of mineral matter. The organic constituents of wheat, oats, etc., are: The woody fiber, next comes the starch, then the sugar, gum, and oil, and after these the two nitrogenous substances, the albumen and the gluten, which contain large quantities of nitrogen, these latter being the flesh-forming substances in wheat; the others are the fat-forming substances; and the mineral ash contains the constituents which are necessary for building up the structure of man. Let us examine these bodies in their proper order.

If we take a piece of paper or wood, or almost any organic substance, we find that it contains a very large quantity of woody fiber. Hemp and flax also contain large quantities of this fiber, which is the back bone of the plant. Starch is a white, glistening substance which will not dissolve in water, although it will mix with it in small quantities. Potatoes, wheat flour, and oatmeal are chiefly composed of starch. Sago and tapioca are pure starch. To detect the presence of starch, put a little iodine into the substance to be tested; if it turns blue, chemistry will at once tell you that starch is present. To detect the presence of iodine, you have only to get a similar reaction, by applying starch; and although there are many different forms of starch, which may be distinguished by the microscope, it may always be detected by iodine. Gum and sugar are also present, as we have already stated, but the quantities are so small as to call for no special remark. Albumen exists not only in the vegetable, but also in the animal kingdom. The white of an egg, for instance, is entirely pure albumen. It is met with in flesh, and is the commencement of the formation of muscle. One of the chief characteristics of albumen is its coagulation by heat. The coagulation may be easily effected by chemicals. For instance, nitric acid will do it; and although albumen and gluten are both nitrogenous substances, gluten cannot thus be coagulated. Both are found in wheat. Gluten is of a very tenacious character, and makes good birdlime. Oil is chiefly found in many seeds of plants, generally in the outer portion of them. In making wheat flour, we ordinarily throw away that which we ought to retain, that which is the source of the development of the bony structure, namely, the woody fiber, and keep the starch.

Of the mineral or inorganic matter of cereals, water is 14 per cent, while the principal constituent of wheat, phosphoric acid, is present to the extent of 40.91 per cent, potash being 31.30, and silica only 9.71. The silica of wheat is identical with the widely diffused silica of sand and flints, and is combined in cereal products with alkali, in which it is soluble. Silica, taken alone into the system, would pass right through; and to secure its assimilation to the human body, it must be connected with potash or soda. But it can be recovered from its solutions by putting nitric acid in the mixture; it at once separates in the form of solid flint. The ash of wheat contains nearly 10 per cent of this substance. It may be seen in the glaze on straw, and some plants are

almost entirely composed of silica. Phosphorus and lime are the chief bone-making elements in cereals, bones being nearly one half composed of phosphate of lime; and artificial phosphates of lime are largely used as manure for wheat. There are two kinds of phosphate, soluble and insoluble. The insoluble phosphate takes years to decompose; therefore, in order to grow wheat by it, it must be converted into soluble phosphate, such as the superphosphate, familiar to our agricultural readers.

Plants require two kinds of food, vegetable and mineral, or rather organic and inorganic, as the former constituents are also to be obtained from animal matter; and the inorganic matter is found in the soil and in the air. But altogether, growing cereals must be supplied with nitrogen, carbon, silica, and phosphoric acid; and without these, no profitable crops can be obtained.

WHEN IS WATER UNFIT TO DRINK?

BY PROFESSOR ALBERT E. LEEDS.

There is perhaps no question more important to the inhabitants of many cities, nor one which more severely taxes the resources of applied science, than the determination of the fitness or unfitness of a water supply. The difficulty arises from the fact that, in some cases, a water may have taste, smell, color, and a considerable amount of foreign matter, and at the same time be drunk with little or no injury; while another water, which is agreeable to the taste, limpid, colorless, and with little foreign matter, may yet contain abundant sources of disease.

The literature of the subject shows that there are two classes of thinkers, one of which puts great faith in the efficacy of natural agencies to bring about the purification of polluted streams, the other which contends that the only safe plan is to reject water which has ever been contaminated by sewage, etc. The evidence elicited by the Royal Commission on the water supply of London is that principally quoted by both classes, and cannot be regarded as conclusive. The rapid extension of our knowledge in this branch of sanitary chemistry is such, however, that we may anticipate greater certainty in these matters, and imparts great interest to some recently published methods of investigation. Anyone who refers to analyses, made a few years back, will find that it was deemed sufficient to give the character and amount of the mineral substances contained in the water, while the organic and volatile substances were expressed in a sum total, no attempt being made to determine their precise character. But, except in cases where the mineral substances were positively detestable or excessive in quantity, this did not settle the question. Of late, the greatest attention has been paid to the organic constituents, and the analyses state what amount of putrefiable matter is present. A careful determination is also made of the amount of ammonia, and of nitrous and nitric acids. These are regarded as the forms which the organic matter in large part assumes after it has passed through the putrefiable stage, and indicate therefore the degree of previous contamination.

But it is said, and with truth, that all these things may be known to a wonderful degree of nicety, and yet there may be substances present capable of rendering the water altogether unsafe for drinking. It is urged that the living organism is exceedingly sensitive to substances whose capacity for injury is fatal, even when present in amount so small as to render their weighing, and even detection, impossible. But of late, the fauna and flora of water courses have been studied, with a view of learning what assistance they could be in the matter, and the results are highly encouraging.

It has long been known that dissolved oxygen played a great part in the purification of streams, and was the principal agent by which putrefiable substances were broken up and converted into harmless inorganic compounds. A recent essay by M. Gerardin, to which the prize was awarded by the Paris Academy of Sciences, contains some striking results obtained by the above-mentioned methods of investigation. To summarize, these methods were:

1. A determination of the amount of oxygen held in solution.
2. An observation of green plants and aquatic mollusks.
3. A microscopic examination of algae and infusoria.

It is claimed that the results obtained by these three methods were identical, and that, where the water was clear, with abundance of fish, watercress, etc., the water contained a correspondingly large amount of oxygen; while in places where the dissolved oxygen was small, fish and the higher types of aquatic plants were wanting, and certain low forms of vegetable growth had taken their place. The river Vesle in France from Rheims to Braisne was taken as the field of observation. It was studied over a distance of 37½ miles, during which it received the sewage of one large town (that of Rheims, the daily flow of which amounts 4,180,000 gallons) and other impurities. Above Rheims, the water (which was clear, wholesome, and with abundance of fish, charas, watercress, iris, etc.) contained 0.66 cubic inch in 61 cubic inches of water. In passing through a suburb above Rheims, the Vesle received the refuse of some dye works, which colored the water; and in place of the fish and watercress, *sparganium simplex* makes its appearance. At a point where the water had received the contents of the five principal sewers of Rheims, the water was thoroughly polluted and contained but 0.03 cubic inch of oxygen in 61 cubic inches. Two species of algae, the *biggiana alba* and the *oscillaria natans*, were developed largely, the latter to such an extent that the whole surface of the sluggish water was covered with a thick blackish coat.

This coat was seemingly so solid that animals and even men have rushed on it, mistaking it for terra firma. Above the mill at Macan, where the oxygen had increased to 0.45

cubic inches, the two varieties of algae mentioned above had disappeared, and the bed of the Vesle was covered with a long whitish algae, called *hyphothrix*.

At Compensé mill, the oxygen had increased to 0.5 cubic inch, the *hyphothrix* had almost completely disappeared, and the *sparganium simplex* was again abundant. Below this point the amount of oxygen increased, and with it a corresponding change took place in the vegetation until, at Braisne, the water contained 0.66 cubic inches of oxygen per litre, all traces of pollution had disappeared, and fish and watercress flourished.

From this it would appear that a properly aerated and pure water showed, when polluted, the amount of pollution by a corresponding diminution of oxygen, by the appearance of *sparganium simplex*, *spirogyra*, *hyphothrix*, *biggiana* and *oscillaria*, and a progressive improvement by a corresponding increase of oxygen, and the appearance of these plants in reverse order. It remains for us to apply and extend this knowledge to our own streams. Fortunately, the means are not wanting, since the great monograph on the fresh water algae, magnificently illustrated with plates, by Dr. H. C. Flood, which was not published by the American Philosophical Society, has been recently printed by the Smithsonian Institution.

THE FAIR OF THE AMERICAN INSTITUTE.

After a successful exhibition, the fair has closed. The display, remarkably good in the early weeks, improved as tardy exhibitors gradually added their contributions, until, during the closing days, every available foot of space was filled with a variety of articles certainly exceeding in interest, if not in numbers, those presented at the fairs of several preceding years. The venerable Institute, we think, needed the new life which evidently has been infused into it, to rescue it from the state of respectable fossilism into which it was rapidly lapsing. Its fairs, therefore, have been conducted more on the principle of advertising a few steady exhibitors, and furnishing a chronic yearly grievance for a very large number of others, than as an instructive and attractive exhibition for the general public. The energy which has characterized the management of the fair just over has worked a great change for the better; and since the favor of the public has been courted by means well calculated to win the same, it is to be hoped that the substantial rewards thus fairly merited have been received.

During our last stroll through the building, we noted a few novelties which have recently been added. Of these, we give brief descriptions below: Captain J. B. Stoner, of life-preserving-suit fame, exhibits three huge models of

FLOATING LIGHTHOUSES

or telegraph stations. These are large floats made in different ways, some being tanks, others being stages supported on buoys. It is proposed to moor these in deep water, and to connect them with the submarine cable, so that ships reaching them during their voyages may be able to transmit intelligence to their owners or consignees. A superstructure of light and strong construction is raised on the floats, and is suitably built either for a lighthouse tower, fog whistle, or any other purposes desired. Whether these peculiar craft can be moored at sea so as to withstand heavy weather is questionable; but it seems that the system of large floats with houses built on them might serve better for hospital purposes than the old hulks which have been devoted to that end in the Quarantine Station near this city.

A NEW PIN

is exhibited, which will become quite popular, we think, for many purposes, on account of the impossibility of its working out of the fabric in which it is placed. It is made of a piece of ordinary wire sharpened at both ends. One extremity is then turned down and wound spirally for a couple of turns about the shank. When the pin is inserted, a slight twist given to the bent end causes the sharp point on the spiral to catch and enter in the cloth. The inventor has not only devised the pin, but some very ingenious machinery for its manufacture. One apparatus cuts off the wire, sharpens the ends, and throws the piece into a hopper, whence it passes into another machine which produces the spiral. The rate of production of the pins is about 200 per minute. Mr. R. W. Huston, of Brooklyn, N. Y., is the inventor.

We mentioned, last week, the

MINERAL WOOL

made of blast furnace slag, which a mistaken foreign contemporary announced as a new German invention. Specimens of this material have been exhibited at the fair, manufactured under the Player patent, granted in this country in 1870. The wool weighs about 30 pounds per cubic foot, and is sold at 2 cents per pound. It costs about 5 cents per square foot of surface, 1 inch in thickness. It closely resembles genuine wool, but is of much shorter fiber, and is somewhat gritty. From a report of tests made by a committee of the Franklin Institute, we learn that, when used as felting, the mineral wool retains heat somewhat more than one tenth longer than common felting. The material is entirely indifferent to dampness and fire, and does not decay.

A NEW CESSPOOL

is exhibited, in which the novel feature is a stirrer, shaped like a propeller blade, and placed horizontally near the bottom. It is mounted on a vertical shaft, which terminates in a crank handle above. During a rainfall, when water is escaping rapidly through the sewer pipe leading out of the cesspool, the crank is turned first one way and then the other, until currents are established in the mass, when the latter is carried into the sewer. It is stated that, by this

means, cesspools can be rapidly and effectually cleansed, without manual labor.

A CAPPING MACHINE,

for affixing the metallic caps to jars, is a useful invention for druggists, grocers, and others who put up large quantities of bottled goods. The cap is placed in position over the cork, and the top pressed against a die, which, being supported by a spring, yields, allowing swiftly revolving smoothers to act upon the cap, behind the rim of the bottle mouth, and press it neatly in place. Various sizes of dies are used for different bottles. A gross of caps are easily attached in about fifteen minutes.

ARTIFICIAL HONEYCOMB FOUNDATIONS,

prepared by Mr. John Long, a well known apiculturist of this city, are a novelty, and one which, it seems, may be productive of considerable economy in the cost of securing honey for the markets. It has been estimated that the actual cost of a pound of comb is equivalent, at least, to that of twenty-five pounds of honey; and beekeepers cannot, without considerable loss, afford to melt down any combs that can be used to advantage. Mr. Long makes comb foundations of pure bleached wax, and from these the bees raise their cells on an amount of feed which ordinarily would not induce them to build comb at all. The foundations, it is said, make white delicate guides. They are very easily fastened in the boxes, and honey stored in them has been shipped long distances without damage either through leakage or fracture, and the bees seem to like the improvement. Thus even the honey bee has become the patron of a patented invention.

SCIENTIFIC AND PRACTICAL INFORMATION.

FERMENTATION FROM INORGANIC SUBSTANCES.

M. Mairer communicates to the French Academy of Sciences a curious experiment which, from the extraordinary result, leads to the belief that either the author has failed to take into account some circumstances not noticed, or else that a discovery of importance, worthy of further and careful investigation, has been made. He says that he mixed acetate of potash, nitrate of potash, and phosphate of soda together, all being in aqueous solution. At the end of a few days, the acetic acid appeared to be destroyed, nitrogen was disengaged, and the liquid contained only carbonate of potash and phosphate of soda. The action may be compared to a sort of fermentation in the case of the acetate, and more especially since it was accompanied by the development in the liquid of a glassy substance, similar to that which sometimes accompanies the fermentation of sugar.

GAS FROM DEAD ANIMALS AND SEWAGE.

A process of making gas from dead animals, sewage, and other refuse, which recently received a very favorable report from a commission appointed by the authorities of Breslau, Germany, has been subjected to extended practical tests and proved a failure. The material produces less than half the gas than is evolved by an equal quantity of coal; it costs twice as much, and requires a special combustible; and the gas is so full of impurities as to render its purification both difficult and very expensive.

DISCOVERY OF TELLURIUM IN CHILI.

For a long time tellurium was found only in Transylvania but of late years deposits of it have been discovered in Turkey, and in Colorado and Nevada. Recently the element has been found in Chili in the shape of tellurate of silver or tellurate of lead.

THE ENGLISH 81-TON GUN ECLIPSED.

According to the *Kölnische Zeitung*, Krupp is making preparations for the construction of a 124-ton cannon. This enormous gun will throw steel bolts weighing more than 2,200 lbs. each, and will require a load of powder weighing 400 lbs. It is estimated that the projectile will pierce at a distance of 3,200 feet the heaviest plates, of 23.8 inches thickness, now used on the English ironclads, and that its extreme range will exceed seven miles and a half.

A NEW ADULTERATION OF PORT WINE.

This new adulterant, unlike many others, is easily detected by non chemists, and is in some cases dangerous, especially when partaken of by the feeble, delicate, and convalescent. It is an artificial coloring, which, Shuttleworth says, consists of a mixture of azalin and magenta red. The aniline colors, objectionable in themselves, are the more dangerous because they not unfrequently contain arsenic. The adulteration is detected by shaking the suspected wine (and all cheap wines are to be suspected) with an equal volume of amylic alcohol (fusel oil). If the wine is genuine port, the amylic alcohol remains colorless; but if adulterated, it dissolves out the coloring matter, and itself appears of a purple red color.

The coarse long hair from the neck of an old chamels, if drawn between the finger and thumb from the root to the point, becomes positively electrified, but if drawn in the reverse direction it becomes negatively electrified.

A piece of wood cut from a tree is a good conductor; let it be heated and dried, it becomes an insulator; let it be baked to charcoal, it becomes a good conductor again; burn it to ashes, and it becomes an insulator once more.

R. H. H. send us the following recipe for staining light wood in walnut color: Take asphaltum varnish 1 part, turpentine 3 or 4 parts, linseed oil 1 part, and Venetian red ground fine in oil to suit. This will impart to light wood a good imitation of walnut, so that it can hardly be detected.

THE HEMATITE IRON MINES OF ENGLAND.

The creation of a new field of iron manufacturing industry in Cumberland and Lancashire, England, is mainly due to the success of the Bessemer steel-making process, for which the hematite ores of that district, although long neglected, are found to be especially suitable. The town of Barrow-in-Furness has grown out of this important trade, and many other busy scenes are largely increasing their population and resources. Landowners and farmers are investigating the strata which underlie their possessions, and companies for raising iron ore and bringing it into market, as well as for manufacturing the metal on the spot, are becoming very numerous. The geological features of the ore-bearing formations are full of interest, and they are generally well defined, and prospectors look upon them as certain indications of the presence of metal.

We publish herewith sections of the Montreal mines of West Cumberland, distant about five miles from Whitehaven. They are the property of Mr. John Stirling, and are situated on a band of mountain limestone, which extends from Egremont to Cleator Moor. On the east of this limestone formation are found slates, the basic rocks of the district, on the edges of which, upturned, the limestone reposes. To the west of the limestone are the coal measures, brought into contiguity with the limestone by a large fault, bearing nearly east and west.

The limestone is in many places capped by the millstone grit; and it is between this latter group of rocks and the underlying limestone that many of the iron deposits in the district are found. The form they assume in this position approaches that of a bed. Other deposits in the limestone are found lying by the side of the large fault, which brings the limestone and coal measures into contact. Among the deposits in the latter position is the one which constitutes the greater part of the Montreal mines, a section of which is shown in Fig. 1. An other set of deposits occurs in shallow basins in the limestone, covered only by the boulder drift, or, at most, with a very thin shell of rock. To that description belong the remainder of the deposits worked by the proprietor of the mines under notice; a section of one of these last is given in Fig. 2.

The method of working the Montreal mines is partly shown by the drawings. When the shafts have been put down to a sufficient depth, a level is put out a few feet below the top of the ore, and when that level has been continued to a sufficient distance, say five or six fathoms—that is, supposing the foot of the shaft to be on ore, as in the case of No. 1 shaft, Fig. 1—levels are put off on each side. From these, other levels are put off in their turn; and so on, until the whole of the deposit at that height has been opened by a sort of post and stall system of working. The size of the levels—or rather workings, as they are called—is variable; they are sometimes 30 feet wide and about 20 feet high, but as a general rule they are only about 12 feet square in section. The size of the pillars also varies very much, according to the nature of the ground. Sometimes they are very large, consisting almost entirely of rock; but where the ore is not interfered with, or mixed up with limestone, they are from three to five, or even six, fathoms square.

While the first height of workings is being wrought out in the manner described above, the second is commenced about five fathoms below the first, and carried on in much the same way. A third and fourth height may also be put out, if the size of the deposit renders such a course advisable, to be worked in the same manner; but by the time the fourth height has been thought of, it is probable that a great many of the pillars in the first height, and perhaps in the second also, have been taken away, and the roof allowed to fall in. Unless this extraction of the pillars is accomplished in a very systematic manner, it is more than probable that a great many of them will become buried in the debris of the fallen roof; in which case drifts, timbered as they proceed, have to be driven through this fallen rubbish for the purpose of reaching the ore. If much ore is extracted in this way, a very large amount of timber is required, as the ground, when once thoroughly broken up, brings such an enormous weight on to the timber by which the drifts are kept open that it very frequently requires to be repaired.

The output of the Montreal mines is now 250,000 tons per

annum, which is the largest turnout of any mine in either the Whitehaven or the Furness district. The area is about 1,000 acres, of which nearly half is ore-bearing ground. The total number of hands employed above and below ground varies from 1,000 to 1,200, figures which give an idea of the importance of the enterprise. There are altogether twelve shafts, of which three are now in process of sinking, while the remaining nine are in active operation; the greatest depth at present attained is about 75 fathoms. In addition to the shafts there is an open working from half an acre to an

serve as an effective preventive; but as the use of that weapon might lead to disagreeable complications, that plan, together with the scheme of an india rubber car, capable of indefinite extension, must be reckoned as infeasible. They are more civilized than we are in Russia, for there they have a rule that no more people can enter a car than there are seats vacant; the same excellent regulation is enforced in some Paris omnibuses. Sometime in the distant future we may have a similar regulation; but until that happy period arrives, it behooves us to consider the best means for ameliorating the present unfortunate state of affairs.

To Mr. Cevadra B. Sheldon, a gentleman thirty-one times a patentee through the Patent Agency connected with this paper, is the public indebted for the happy idea shown in our engraving, for relieving the standing committee in horse cars, who heretofore have had to ride for miles, wearily hanging to a greasy strap, and whose toes woefully attest the solidity of the conductor's pedal extremities as that individual, bell punch in hand, ruthlessly tramps up and down the narrow passage.

Mr. Sheldon's invention provides extra seats, arranged as shown in the engraving, to be folded under the main seat when not in use, and to be readily shifted into position in front of the main seat by means of suitable standards. The standard is bolted to a riser a little below the main seat, and is so shaped that it supports the auxiliary seat far enough forward to be out of the way of the passengers' legs. The standard has a locking joint for holding it up and a lug for maintaining the seat level. The seat is prevented from oscillating; and when folded, the top side turns inward so as to be protected from dust. The mechanism is exceedingly simple and strong, and may be modified in various ways to meet different requirements.

The device is one which might be added to both street cars and stages, with profit both to the passengers and to the owners. It would prevent the crowding of the passage, and would increase the seating capacity of the vehicle probably one half. The companies

who manage our public conveyances would do well to put themselves in communication with the inventor. His address is No. 7 State street, New York city.

Salt.

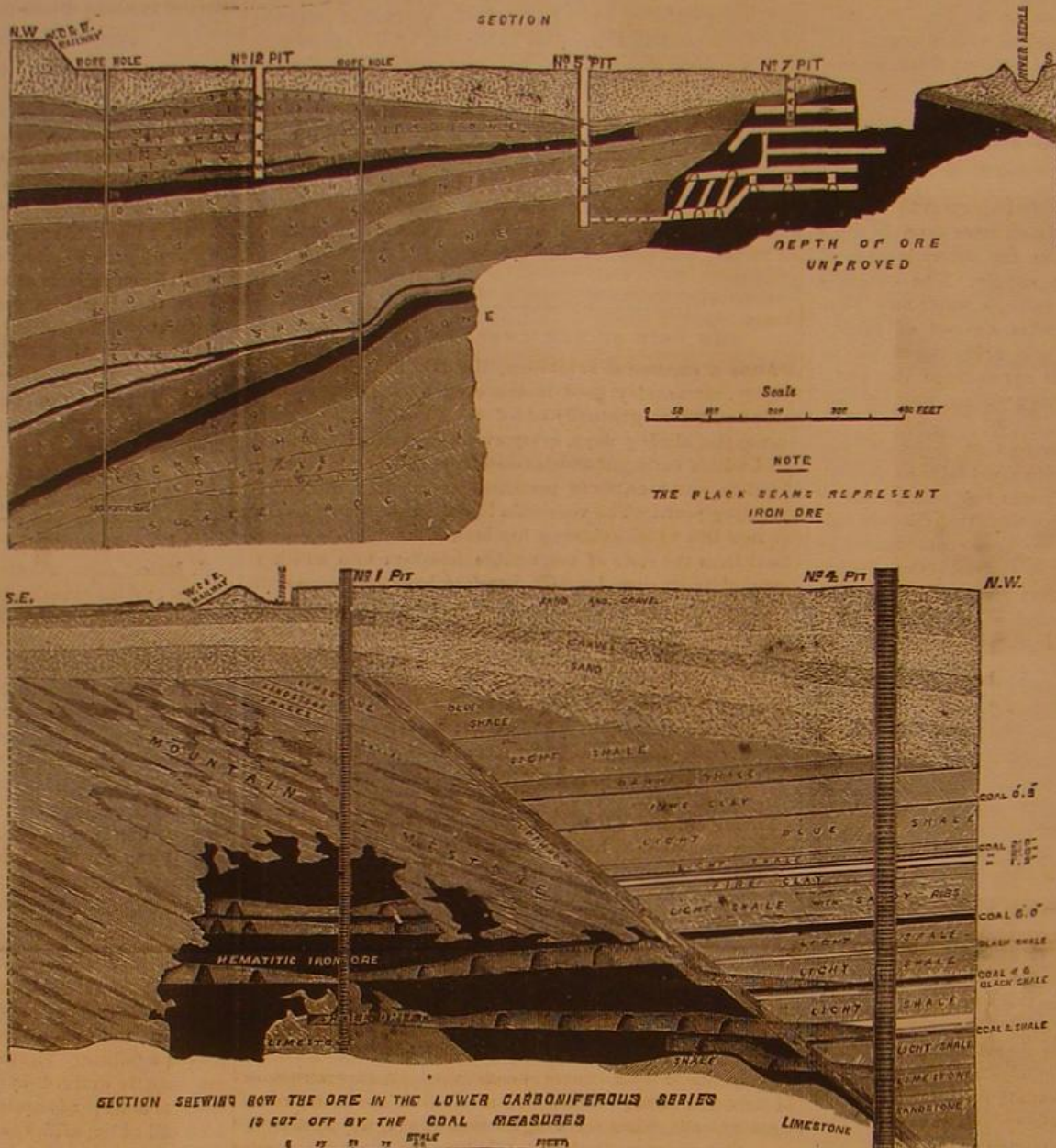
Hall's Journal of Health thus sums up some of the many uses of salt: "It will cure sick headache, make cream freeze, make the butter come, take inkstains out of cloth of any kind, kill wens, kill worms, make the ground cool; so it is more congenial to celery, cabbage, etc. It will ease the itching pain caused by irritating skin diseases, like hives, itch, etc. It will produce vomiting or stop it, as you like; and many other things too numerous to mention. All pure salt will do this to a certain degree, but sea salt is the most effectual in its action."

Salt is a most remarkable and highly useful substance; but we think that our cotemporary will find, on practical trial, that the article will not do all that is above claimed. For example, salt will not make cream freeze, it will not take inkstains out of cloth, and probably will not do more than one or two of the other things abovementioned.

Tunnel at Rio de Janeiro.

The Brazilian Government have under favorable consideration a project by Mr. Bucknall for connecting the north and south railway system of the empire with the capital, by a tunnel, under the narrow entrance to the bay of Rio de Janeiro, between the capital and the submarine city of Niteroy, a distance of about two miles. The preliminary investigations clearly demonstrate the practicability of the undertaking; and its important bearing on the future of the country will be apparent to those acquainted with the commerce, railway system, and topography of that part of the empire. Mr. Peter W. Barlow, C.E., has gone to Rio, commissioned to conduct the survey and prepare the necessary plans and estimates.

Corn-fed hens do not lay in winter, for the simple reason there is no albumen material in the corn. When wheat is given to them, there is fat enough in it to supply all that is needed for the yolk, and albumen enough to make the white and lime enough to furnish the shell; it does not thus seem difficult to understand why corn-fed hens should not lay, as they do not, and why wheat-fed hens should lay, as they do



THE MONTREAL HEMATITE MINES CUMBERLAND ENGLAND.

acre in extent, but the outcrop ore only is here being worked

SHELDON'S AUXILIARY CAR SEAT.

The fact is pretty generally recognized that, so long as there is an available inch on which a foothold can be got, either inside a street car or on a platform, people will endeavor to



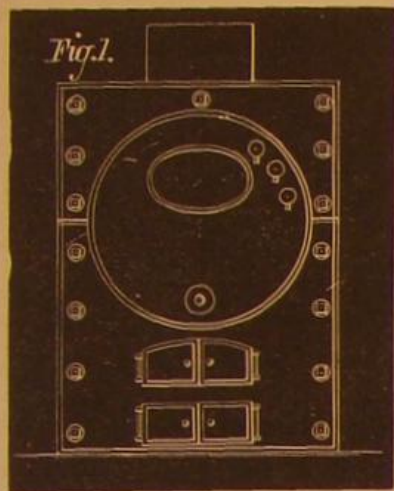
occupy that space, and there they will remain, clinging to strap or bar, in positions uncomfortable both to themselves and to those whom they crowd. Nothing short of a sentry with a sharp bayonet, stationed at each end of every car, will

SETTING BOILERS.

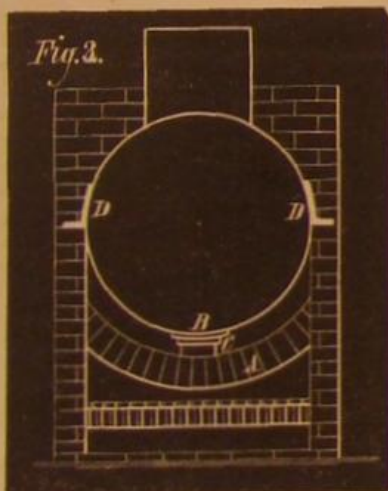
This subject seems to be generally neglected by writers on the steam engine. When a boiler is to be set, the ordinary plan is to send for a mason and entrust the work to him, without giving any specific directions. The result of such a course can easily be foreseen, and an examination of numerous boilers shows that there seem to be no rules for setting them that are adopted as standards. The practice of boiler makers, who furnish the necessary irons for setting boilers in brickwork, is also quite varied; so that a mason, however experienced he may be, cannot always do the work in the best manner possible. In view of these facts, it may not be amiss to devote a little space to the description of the best methods in use.

I.—THE BOLTS AND CASTINGS.

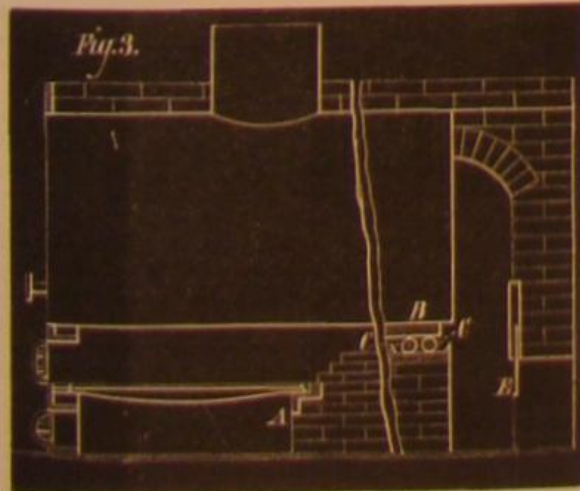
The irons usually employed in setting a boiler in brickwork are: The front, tie bolts, bearing bars, grate bars, supports, damper, connection, and chimney doors.



The front, shown in Figs. 1 and 4, should be made high enough to extend above the top of the boiler, so that the side walls and back can also be built up and the boiler covered on top. For the sake of cheapening the price of the fixtures, some boiler makers furnish a low front, so that, when the boiler is set, the top is left uncovered. Although this plan reduces the cost of the fixtures and setting, it is the dearest in the long run, since there is a great loss of heat by radiation from the uncovered portion of the boiler.



The supports for the boiler may be of two kinds, a single support at the end for a boiler of ordinary length, and intermediate supports for a long boiler. The best form of support for the end of a boiler is shown in Figs. 2, 3, 5, and 7. The boiler rests on a cast iron saddle, B, which is supported on rollers, C, the latter resting on a plate, D, on the brickwork. By this arrangement the boiler is free to expand and contract under changes of temperature. Sometimes the boiler is supported by lugs, D, Figs. 2, anchored in the side walls;

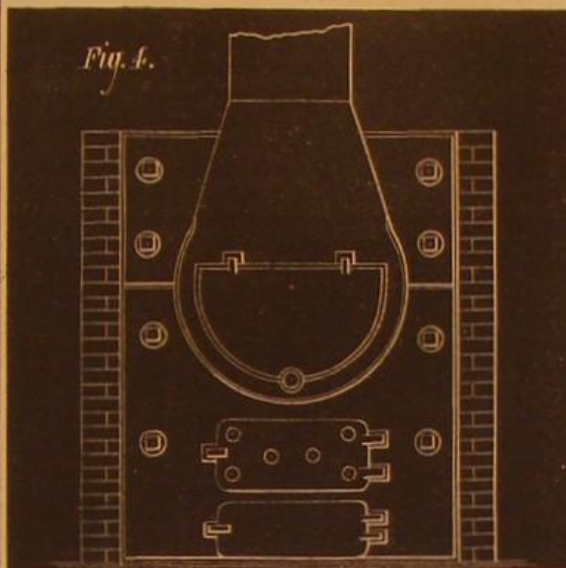


but this should only be done in the case of very short tubular boilers, and the roller support is preferable for every case. Very long boilers require to be supported at intermediate points. This is commonly done by means of suspension rods, which can be adjusted by nuts, but this practice is by no means commendable. When a flue is made under a long boiler, the bottom becomes more highly heated than the upper portion, so that the boiler tends to take a curved form

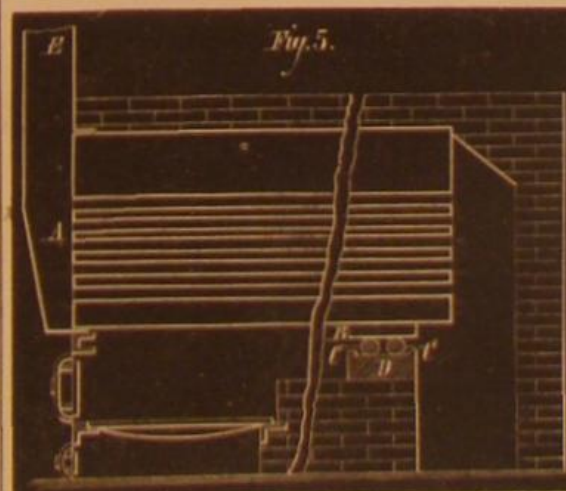
If rigid suspension rods are used, this curving is prevented, and in many cases fracture occurs, or the boiler is said to break its back. Mr. Head, an English engineer, has devised a form of suspension rod, which is easily constructed and effective. This is represented in Fig. 7. The suspension rods, E, are attached to a plate, D, on the boiler, and, instead of being rigidly secured by nuts to the guard, F, have stiff volute springs, G, which keep the boiler in proper position when cold, the rods having lugs, e, to check the action of the springs at the proper point. Of course, when the boiler is heated, the springs will allow it to be drawn down, and it will return to its normal position when cooled. If the weight of water in the boiler is considerable, suspension from the top might produce distortion of the circular form; and to counteract this, a piece of angle iron, H, may be secured within the boiler.

The bolts are often used to connect the two side walls. The ordinary form is represented in Fig. 6, the bolts passing through castings, B, which act as large washers.

The damper is generally a slide, as shown at E, Fig. 3, which is placed at the junction of the back connection or connecting flue with the chimney. Openings should be left large enough to permit a person to enter the back connection and chimney, and these are closed by the connection and chimney doors.



The bearing bars are for the supports of the grate bars. The front bearer is often cast on the front, or bolted to it, and the back bearer is laid on the bridge wall. In the case of long grates, an intermediate bearer is required, which is anchored in the side walls, and supported on the middle on bricks, if the grate is also very wide. It is better, however, instead of using one wide furnace, to divide it by walls or arches into several narrow ones, both for convenience and economy in firing. Wide furnaces have sometimes been divided in this manner, after the boilers were set, producing a considerable gain of efficiency. The arrangement of the boiler front fixes the position of the grates, or their distance below the boiler. There is not a great deal of difference in the practice of boiler makers, with respect to this distance, which is usually between 18 and 24 inches—generally nearer the former figure.



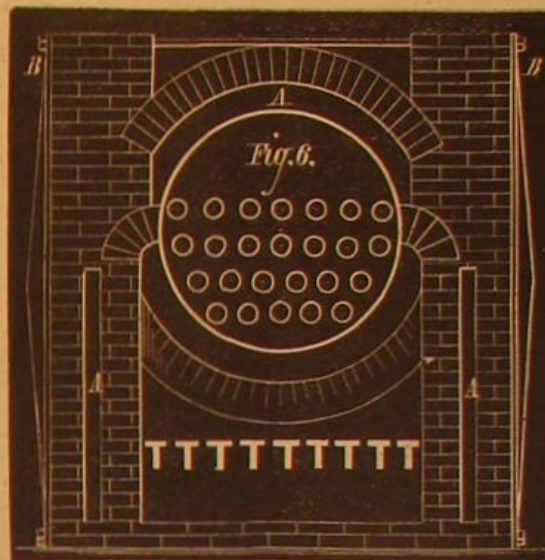
It is obvious that the iron front can be dispensed with, if desired, and the boiler sustained on brickwork alone. This is quite frequently done, but the plan does not appear to possess any special advantages, since, if the setting is properly performed, it will be quite as expensive as if the iron front were used.

II.—THE BRICKWORK.

The general arrangement of setting for a plain cylinder boiler is shown in Figs. 1, 2, and 3, and calls for little remark. In the engravings, the top of the boiler is covered with brickwork; but it is a very common plan to run up the walls to a sufficient height, and fill in the space with dry earth or sand. Whichever course is pursued, the brickwork should be carried up high enough around the boiler to make a tight joint, so that none of the heated gases can escape. It will be seen that an arch is turned to form the bridge wall. This, however, is a matter of no importance; and if is more convenient, a horizontal bridge wall can be built, care being taken to leave the proper opening between the wall and the boiler for the passage of the products of combustion. An

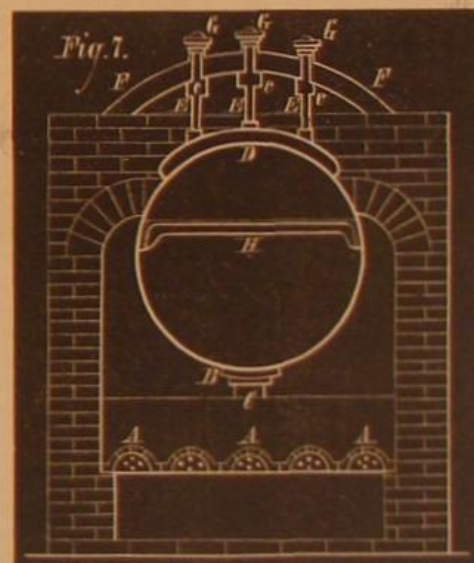
average value for the proper area over bridge wall is three twentieths of the area of the grates; and though in practice this area is very differently adjusted by different masons, the best results are obtained when the area is an approximation to the figure given above.

In the engraving the grate bars are set level. They are frequently dropped a little at the back, on account of some supposed advantage in firing. There is no objection to this practice, and it is extremely doubtful whether any benefit is derived from it. It will be seen that the front is secured to the brickwork by bolts, which are built into the wall, with large washers on the ends. The boiler front, the side walls, and the bridge walls should be lined with fire brick set in fire clay. If any pipes are brought from the boiler through the brickwork, openings should be made for them, closed with iron doors, so that they shall be readily accessible for exami-



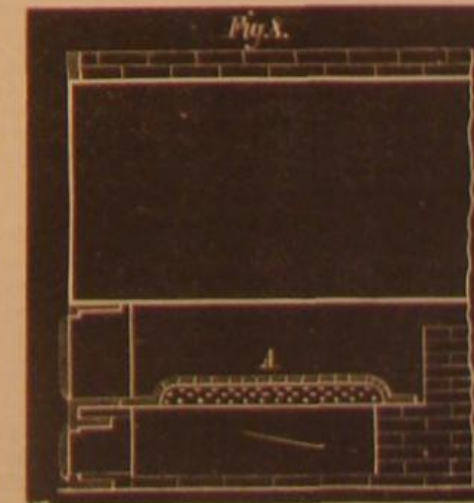
nation and repairs. It is better, however, to attach the pipes to the front or back of the boiler, where they need not be built in.

The setting suitable for a tubular or flue boiler is shown in Figs. 4 and 5. Here the products of combustion, instead of passing from the back connection to the chimney, return



through the tubes or flues to the front connection, A, and thence pass to the chimney by the flue, E. The engraving shows one of the best arrangements of fronts for this kind of boiler.

In Fig. 6 is shown what is probably the best manner of setting a boiler in brickwork, namely, with double walls and an air space, A, between, to prevent loss of heat from radiation. It is much more expensive than the ordinary setting,



and must be done with great care to make solid and stable walls.

III.—FURNACES FOR SAWDUST.

There are several patent furnaces for burning sawdust and tan bark, which are said to be very economical and efficient; usually, however, in a sawmill it is more important to get rid of the sawdust than to burn it with great economy, and

in such a case the furnace represented in Figs. 7 and 8 will answer every purpose. The boiler should be quite short, and the grate surface and area over the bridge wall should be about twice as great as for coal. A peculiar form of grate bars, known as cone grates, shown in the engravings, should be employed. These bars can be obtained from almost any builder of portable engines. The furnace should be set back some distance from the front, as shown in Fig. 8, leaving a flat plate, on which the sawdust is first piled, and gradually pushed upon the fire as it becomes dry. It is generally well to have at least two distinct furnaces, which can be fired alternately. It is also necessary to have a high chimney or a forced draft.

IV.—THE CHIMNEY.

The chimney may be constructed either of iron or brick-work, and as high as is convenient. It should be at least from 40 to 50 feet for good effect, and can, of course, have its height increased to advantage. It is well to make the chimney with the same internal cross section throughout. It is generally considered that the circular section is better for a chimney than a square or rectangular section, and the interior should, of course, be made as smooth as possible. Chimneys are frequently constructed with double walls and an air space between, forming two distinct chimneys, the inner one of which is lined with or often wholly constructed of fire bricks. The cross section of a square chimney should be at least seventeen one-hundredths of the grate surface of the boiler, and for a round chimney, thirteen one-hundredths; but it is a good plan to make the chimney somewhat larger than this, since, if it is too large, it is easy to close the damper, but, if it is too small, the remedy is not so easily applied.

Correspondence.

A Lost Art Re-Discovered and Patented in America.

[From the following letters, furnished by a Detroit correspondent, it appears that, a hundred and fifty-five years ago, in 1720, in the quiet old town of Ross, Herefordshire, Eng., an ingenious individual, John Kyrle, celebrated in Pope's "Elegy" as the "Man of Ross," established a system of water supply for that town, which from that time to the present has been uninterruptedly in use. The distinctive feature of this system consists in forcing water by pumps into the street mains, so as to supply the town with water under such pressure as may be required. At the Ross works the ordinary pressure for many years has been 45 lbs. per square inch.

On March 2, 1869, the United States Patent Office grants a patent for the same system, as a new invention, to Birdsill Holly, and gives him a still broader claim in a re-issued patent, August 2, 1870. It would seem that the broad claim must now be abandoned. But the ingenious valves and the devices for regulation of the water employed in the Holly system will doubtless remain good.—EDS.]

To the Editor of the Scientific American:

There has been a great deal of controversy here about the Holly system of waterworks: Mr. Holly claiming that no one but himself can build waterworks pumping direct into the mains and keeping a pressure on them, as he holds letters patent from the United States for the same. Now, as I understand the law of patents in the United States, a patent will not be granted, and if granted will not be sustained, if the object sought to be covered by patent has been in use before. I have always contended that the "Holly system," so-called, was older than Holly himself.

You have no doubt read Alexander Pope's elegy on the Man of Ross (Mr. John Kyrle); and in thinking over this pumping work, I remembered having seen in my youth some very old pumping works at Ross, in Herefordshire, England, and, believing that they were on the same system as this under dispute, to make sure I wrote to the Mayor of the town of Ross, describing the Holly system to him, and have received his reply; and I would like to see it published (for the use of waterworks contractors and builders) in the SCIENTIFIC AMERICAN, which I believe all such persons read. The letter is as follows:

DEAR SIR:—As I was born in this town in 1812, spending the greater part of my 63 years here, I am enabled to give the information you require. I purchased the waterworks in 1849 and still own them. They were established by the "Man of Ross" about 1720, and have undergone but little modification until now, when steam power is supplemented. As you know, then the water wheel was about 11 feet diameter and 39 inches wide; it drove two six-inch plungers, and was direct-acting or without reservoir, exactly the same arrangement as you describe. It is so now, and I know of but little advantage in storage, except from intermittent sources of supply. * * * As you know the Royal Hotel, I may inform you that it is 94 feet above the plungers, so that I have more than three atmospheres at the works. I pump from the river.

Ross, October 12, 1875.

S. B. WALL, Mayor.

You see by this that this system has been in use to our certain knowledge 155 years, and this should nullify any such claim as that made by the Holly Waterworks Company.

Detroit, Mich.

W. PENDRY, M. E.

Silvering Glass.

To the Editor of the Scientific American:

Having had occasion to silver some small plates of glass, I tried several formulas. In some I found the silver solution so weak that it required repeated applications to give an opaque deposit. In others, the silver was so strong that there appeared to be a waste. After trying several modifications, I found that the following works very finely, giving a heavy deposit by a single application:

No. 1. Reducing solution: In 12 ozs. of water dissolve 12 grains Rochelle salts, and boil. Add, while boiling, 16 grains nitrate of silver dissolved in 1 oz. water, and continue the boiling for 10 minutes more, then add water to make 12 ozs.

No. 2. Silvering solution: Dissolve 1 oz. nitrate of silver in 10 ozs. water; then add liquor ammoniac until the brown precipitate is nearly but not quite all dissolved; then add 1 oz. alcohol and sufficient water to make 12 ozs.

To silver: Take equal parts of Nos. 1 and 2, mix thoroughly, and lay the glass, face down, on the top of the mixture while wet, after it has been carefully cleaned with soda and well rinsed with clean water.

Distilled water should be used for making the solutions. About 2 drachms of each will silver a plate 2 inches square. The dish in which the silvering is done should be only a little larger than the plate. The solutions should stand and settle for two or three days before being used, and will keep good a long time.

New York city.

D. C. CHAPMAN.

The Relation between Spectral Lines and Atomic Weights.

To the Editor of the Scientific American:

The following facts, disclosing an intimate connection between the Fraunhofer lines of the solar spectrum and the atomic weights of the substances whose glowing vapors they represent, will, if confirmed, prove of the highest importance and interest. Being desirous, on this account, of bringing them at once to general knowledge, I send you the following condensed statement, which I hope you will publish.

The Fraunhofer lines of hydrogen gas are, according to Angström's wonderfully accurate measurements (given in millimeters, a millimeter being 0.3937 of an inch):

0.00041012mm.
0.00043400mm.
0.00048606mm.
0.00065618mm.

Their distances from the shortest wave lengths are consequently:

43400—41012=0.0002388mm.
48606—41012=0.0007594mm.
65618—41012=0.0024606mm.

Referring these distances to 0.00041012, the shortest wave length, as a common standard of value, the figures obtained are:

0.00041012:0.0002388=17.1742
0.00041012:0.0007594=5.2747×3=15.7741
0.00041012:0.0024606=1.9082×3= 5.7246

being to each other as 1—3—9. Supposing the quantity expressed by 1.9082mm. to represent 3 units of a certain measure of length, the distances of the H lines increase as the squares of 3: 3—9—27.

The H molecules of the solar atmosphere which give rise to these lines consist of ponderable matter; and (the mechanical force of the luminous impulses having been so recently demonstrated by Professor Stokes) the inference is that refraction, the angles of which are measured and expressed by the wave lengths, is the function of the energy proper to the different constituent particles of the luminous molecules: that these particles are held together by attraction, the common property of matter, decreasing inversely as the squares of distances.

On this supposition, the attractive forces of the H molecule proceed from a center where they are at their maximum; and the distances between the different constituents being known, the value of their attractive energy can be calculated from the constant relation between attraction and distance. To the distances 3—9—27 correspond the respective forces $\frac{1}{3}$ — $\frac{1}{9}$ — $\frac{1}{27}$; and a unit of force, by which the values of attraction of all solar substances can be measured and compared, is represented by the length of shortest waves. In dividing the atomic weights of the substances whose spectral lines are known by the length of their shortest waves, and converting the result into chemical weight by taking the quotient obtained for H=1, the values are as follows:

Atomic weight.	Shortest wave length.	Divided by 2438.
H = 1.00	0.00041012	= 2438=1
Ca = 40	0.00039330	=101704=41.72
Fe = 56	0.00039330	=142385=58.4
Al = 27.3	0.00039428	=69240=28.4
Mn = 55	0.00039882	=137907=56.6
Ti = 48	0.00041631	=115299=47.3
Cr = 52	0.00042532	=122261=50.15
Ni = 58	0.00044020	=131758=54
Mg = 24	0.00044895	=53565=22
Ba = 137	0.00045241	=302823=124.21
Co = 59	0.00045303	=130234=53.4
Cu = 63.4	0.00046510	=136315=56
Zn = 65	0.00046790	=138919=57
Na = 23	0.00049825	=46137=18.9

Notwithstanding the differences, the figures of the last column so closely correspond to the atomic weights that the inference of a near relationship between the spectral lines and atomic weights seems irresistible. When the extreme faintness of the lines in the portion of the spectrum of the greatest refraction is taken into account, some of the difference may not unreasonably be attributed to the existence of shorter waves than those quoted. The definite proportions between differences and atomic weights point to this. Thus 18.9 is nearly $\frac{1}{3}$ of 23; the line corresponding to the atomic weight of 23 is 0.00040900; if this line, which really exists, should prove to belong to Na, the test would be decisive. The importance of the conclusions to be derived from the existence of such relations is apparent. The evidence of atomic molecules, when brought within the reach of scientific investigation, and their dependence on the general law of gravitation, would disclose the inner constitution of matter, the nature of chemical affinity and valency, and the nature of electricity and magnetism; and it would be instrumental in the solution of many problems.

San Francisco, Cal.

E. VOGEL.

Poisoning by Strychnine.

To the Editor of the Scientific American:

I have seen in your issue of September 14 an account of the death of Dr. J. O. Hill, of Ithaca, N. Y., by strychnin, as described by S. J. Parker, M. D.

I once happened to receive a similar dose of strychnin, in the year 1853; but as I knew the remedy, I was cured, being promptly attended to by Mr. Gregson Harrison, who applied the means discovered by Dr. Crace Calvert, in 1852. The remedy is: To counteract strychnin, and cause it to be brought away by vomiting (if it has not been taken more than 30 minutes), pour down the throat $\frac{1}{2}$ grain of nitrate of soda every 20 minutes until vomiting takes place. The patient will then sleep about 40 hours, and awake all right.

The sensations caused by strychnin are first slight pains in the back of the head, then extreme cold in the toes, traveling up to knees; then cold in the fingers, traveling to the bottom of the breast bone.

JOHN PEARSON.

Chorlton-on-Medlock, Manchester, England.

Specific Gravity and Dimensions of Molecules.

To the Editor of the Scientific American:

W. B. M., whose letter appears on page 244 of your current volume is laboring under a great mistake in asserting that the lightness of a substance is not evidence of its possessing larger molecules, and that, if this were true, it would at once dispose of the atomic theory.

I am at a loss to know what he is hammering at. He says: "Take absolute alcohol (specific gravity 0.8) and you will find that, to two similar glassfuls of water, you will be able to add more alcohol than water before overflow." In this he is correct, and this disproves his argument.

But he is also mistaken as to specific gravity of absolute alcohol. Absolute alcohol has a specific gravity of 0.7939 when combined with water at its maximum density, (39.4° Fah.), water being 0.9991.

I stated that the specific gravity of absolute alcohol is 0.7939 and of water 0.9991, making a difference of 0.2052 in the specific gravity, showing that the molecules of alcohol are considerably the larger. Now let W. B. M. take 100 ounces of alcohol of 80 per cent (specific gravity 0.8631), and 104 ounces of water, and he will just have 200 ounces of diluted alcohol possessing a specific gravity of 0.9510, and a strength of 40 per cent. It will be seen that 4 ounces have disappeared, consequently the molecules in the mixture must be of less size than those in alcohol of 80 per cent.

He says that, in the case of heavy liquids, the heavier the liquid, the greater the volume which may be added without altering the apparent volume. Let him try mercury, and the result will be the same as if he had added an equal volume of water.

I have not as yet experimented with mercury, but I have with simple sirup; and I find less contraction caused than with water. I should like again to hear from W. B. M., and hope in his next he will be more explicit. Instead of attempting to overflow a glass, let him employ a given volume of each liquid, and ascertain the resulting volume of each; in this way he can easily find what the greatest contraction caused by combination of liquids is.

San Francisco, Cal.

PRO BONO PUBLICO.

New Mode of Cleansing Cloths and Yarns.

A patent has been taken out in France by M. A. Huet for compositions with bases of glycerin and soap, with or without the addition of an antiseptic, for the purpose of cleansing any textile matter. Glycerin, says the inventor, has the property of being soluble in all proportions of water, and also of dissolving nearly all the substances which water itself dissolves, such as salts, soaps, and metallic oxides.

Starting from this point, M. Huet, after many experiments, arrived at the following composition for wool, which he calls soluble *ensimage*:

Neutral glycerin at 28°	70
Soap	4
Water	24
Solution of oxide of mercury	2
	100

The sulphates, quinine, carbonic acid, etc., might be used as the antiseptic. But the antiseptic is not always necessary, in winter, when there is no fear of fermentation, for instance; for fermentation requires 77° to 86° Fah., and then takes months to establish itself. The solution must be well mixed and filtered.

M. Huet says that he has found, after careful trials, that, by substituting his composition for the oils and fatty matters in ordinary use, the necessity for cleansing cloths during manufacture was entirely done away with, and that they may be fulled at once, without any previous preparation; and thus the danger is avoided of the tints being injured by long contact with the fuller's earth and the alkalies which are often obliged to be added to the earth in order to saponify the oils or other fatty matters. When it is necessary to get rid of size, a simple washing in water will remove both it and the glycerin composition at once.

In other branches of manufacture the yarns must be cleansed before weaving them, in which case also plain water will remove the composition at once. The inventor, therefore, claims for his method great economy in time and money.

The proportion of glycerin to other matters in the composition may be varied according to the nature and fineness of the wool, but that given above is the average amount.

THE strain on belts is always in the direction of their length; and therefore holes cut for the reception of lacing should be oval, the long diameter being in line with the belt

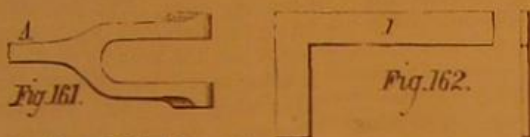
PRACTICAL MECHANISM.

BY JOSHUA ROSE.

NUMBER XXXVI.

LINING OR MARKING OUT.

We now enter upon an entirely new and distinctive part of the machinist's art, namely, the marking work out by lines upon its surface, indicating to what shape and size it requires to be cut. When a piece of work has to be exactly duplicated in large numbers, as in the case of a sewing machine the labor of marking out may be entirely dispensed with by the employment of special chucks and tools, adjusted to suit the requirements of the case; but in all other cases, especially upon large work, the marking-out must be performed, and should be executed with great exactitude, for a variation of the thickness of a line gives the thickness of two lines to file off, entailing upon large surfaces an enormous loss of time. Suppose, for example, a large pillow block to be marked out the thickness of a line too small, and the brasses to be marked out the thickness of a line too large: when both were cut to the lines, the labor of fitting them together would be unnecessarily increased by one third. Nor is this all the mischief, for the inaccuracy of workmanship that will mark off to the thickness of a line too large will sometimes mark off to the thickness of a line too small; and the consequence is that, after a few such experiences (and consequent spoiling of the work), the machine hands will leave the lines on each side of the work as a witness, thus giving the thickness of four lines to be filed off in fitting. Now it

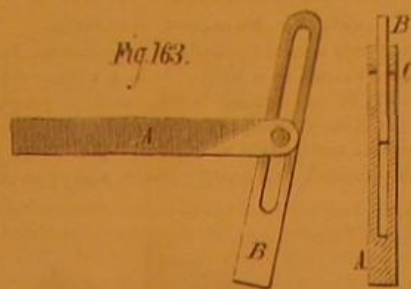


is perfectly true that, in most cases, it is practicable and customary to use gages or calipers as well as the lines; but there are numerous instances in which that cannot be done. Nor is it at all times desirable, because the lines, correctly marked, may be sufficiently correct for the purpose, as in the case of cutting down a surface requiring to be finished but not fitted to anything. Take, for another instance, the stem of a double eye, having an offset, as shown in Fig. 161, at A. In this case, the lines being accurately marked, the proper amount of offset and of thickness, at A, may be more easily obtained by working to the lines than by any gaging or measuring.

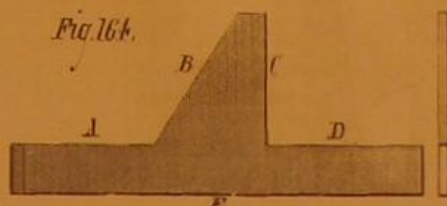
A marker-out, as the operative is termed, should not only be one capable of great exactitude in his measurements, but should also be an expert workman at the lathe, vise, planing machine, and drilling machine; because it is by his lines that the work is chucked, and hence he should know the very best method of chucking or holding the work in each of the machines. Furthermore, a line over and above those necessary to define the outline of the work is often necessary for use as an assistance and guide in chucking it. Upon the truth of this lining, in many cases, will the truth of the finished work depend; and even in those instances where the method of chucking will correct any inaccuracy in the marking-out, the usefulness of the latter is almost entirely destroyed, because the lines will become entirely removed on one side, and left fully in on the other side of the work. If, however, the marking-out is performed reasonably true, one of its main elements of usefulness consists in that it denotes if there is sufficient excess of metal upon the piece of work to permit of its being cleaned up all over. But if there is any one part of the work scant of metal, as is sometimes the case in forgings of unusual and irregular form, the marking-out requires to be very true, and may be made to just save a piece of work that otherwise would have been spoiled. By accommodating the marking to some spot or place in the work, which will only come up to the full size by throwing the whole of the rest of the lines towards the opposite side of the work, a costly piece of forging may be saved from the scrap heap. And again in castings where the surface appears spongy, showing the presence of air holes beneath the surface, or in forgings where the surface may indicate that a weld is not perfect upon one side, the whole of the marking-out should be performed with a view to take off as much metal as possible on the faulty side. In other work there may be a part very difficult to turn or plane on account of the conformation of the job; in which case the marker-out, foreseeing such to be the case, will so place the lines as to give as little to come off that particular place as possible, disregarding the excessive heavy cut or amount of metal which it may be necessary to cut off other and more accessible parts of the work. There are many other considerations, which need not be here enumerated, all tending to show that a marker-out should be a master hand at the various branches of his business, and possess much judgment and experience.

The tools necessary for marking-out operations are a true flat surface plate, having its edges squared true, which plate is usually of cast iron, and enough larger than the size of the work, both in length and breadth, to admit of the use all round the work, of the scribing block illustrated in Fig. D, in a previous issue (page 133, Vol. XXXI.), supposing the line or scriber there shown to be extended horizontally. The ordinary L and T squares, and a flat one of each kind,

as shown in Fig. 163, are required. We have next the bevel square, shown in Fig. 163, A representing the stock, and B

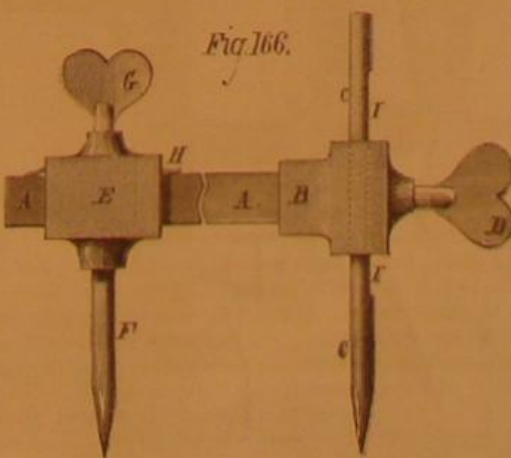


the blade, the latter being provided with a slot so that it may be extended to any required distance (within its scope) on either side of the stock. C is the rivet, which is made sufficiently tight to permit of the movement by hand of the blade, and yet it must hold firmly enough to be used without moving in the stock. Instead of the rivet, C, however, a thumbscrew and nut may be employed, in which case, after the blade is set to the required angle, it may be locked in the stock by the thumbscrew. For the angles of nuts and other hexagonal work, we have the hexagon gage shown in Fig. 164. The edges, A B, form a hexagon gage, and edges, C D, form a square, while the edge, E, serves as a straight edge.



All these tools should be made of cast steel, the blades being made of straight saw blade, so that they will not be apt to permanently set from an ordinary accidental blow; while on the other hand, if it becomes, as it does at times, necessary to bend the blade over to the work, it will resume its straightness and not remain bent. To cut saw blade without causing it to split, as it is apt to do, especially in cutting out narrow square blades, it should be cut by gradually centerpunching it on both sides till it is completely perforated, when a flat chisel may be employed to nick between the centerpunch perforations, the whole operation being performed lightly and repeated until the plate is completely severed.

We next require a pair of long and a pair of short legged compasses, the latter of which should have an adjustable leg, as shown in Fig. 165. A is the adjustable leg, which passes through the split clamp, B, and is locked therein by tightening the screw, C, the object being to always use that leg as the marking one and the other as the pivot, and to lower it as it wears from grinding, thus keeping the compasses of their original length, and for the further purpose of lengthening out the adjustable leg when one of the faces of the work stands much below the level of the other, as we shall find, in some of our examples, will be the case. For long distances, to which compasses would be inapplicable from their excessive size and weight, trammels, shown in Fig. 166, are employed. A A A represents a bar of square steel; or for very long trammels, wood may be used. B represents a head fastened tightly to one end, and through B passes the leg or pointer, C, which is thus adjustable as to its projecting distance, as B can be fastened in any position by the thumbscrew, D. The head, E, is made to a good

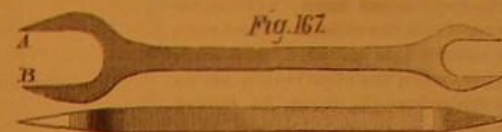


sliding fit upon the bottom and two side faces of A A A; but at the top, there is sufficient space to admit the spring, H H, which passes through E, as denoted by the dotted line. F is the leg screwed into E, which is locked in position by the thumbscrew, G. The head, E, is thus adjustable along the whole length of the bar or rod, A A A. The object of the spring, H H, is as follows: If the head, E, were made to fit the bar, A A A, closely on all four sides, the burrs raised upon the top side of the rod, A A A, by the end of the thumbscrew, G, would be likely to impede its easy motion. Then again, when the sliding head, E, had worn a trifle loose upon

the bar, A A A, and was loosened for adjustment, it would be liable to hang on one side, and only right itself when the screw, G, brought it to a proper bearing upon the under side of the bar, A A A; and thus tightening the head, F, would alter the adjustment of the point. The spring, H H, however, always keeps the lower face of the square hole through E bearing evenly against the corresponding face of the bar, so that tightening the screw, G, does not affect the adjustment, and furthermore the end of the set screw, bearing against the spring instead of against the top of the rod, prevents the latter from getting burred. The flat face, I I, on the leg, C, is placed there to prevent the thumbscrew, D, from raising burrs, which would prevent C from sliding through B. The points of all compasses or trammels should be tempered to a straw color, as should also the points or ends of the set screws or thumbscrews.

FORK SCRIBERS.

For marking small circles, there is no tool equal to a fork scriber, such as shown in Fig. 167, which represents a piece



of steel wire flattened out at the ends and filed to the points, A B, the distance between them being the radius of the circle they are intended to scribe or mark. These tools may be used to advantage to mark circles $\frac{1}{2}$ of an inch and less in diameter, the sizes varying by sixteenths of an inch, and the points being hardened to a brown or straw color.

A Pocket Gymnasium.

The profits from patents on small inventions are practically illustrated by the recent introduction of an elastic tube, about 2 feet long (not unlike a small india rubber garden hose), fitted with a plug of wood at either end, and a cord running loosely through the tube, fastened at each end by a knot to the plug, to prevent injury from the flying ends of the tube in case of breakage. The object of this invention is to furnish a portable exercising device, which is inexpensive, and is designed as a substitute for the more complex and costly health lift apparatus. A patent was secured through this office for the invention last June, and we are informed that the demand for the device has become so great that the manufacturer finds it difficult to meet it, thus confirming what we have repeatedly stated, that there is always a ready sale for small patented inventions. The article referred to is advertised in another column; and for persons of sedentary habits, or ladies and children needing physical exercise, we would recommend a trial of the new pocket gymnasium.

Makarov's Mats.

As a substitute for sails in stopping leaks in ships, Lieutenant Makarov, a young officer serving in the Russian navy, designed a mat of peculiar construction. The Makarov mat has for its basis a closely worked structure of rope about $\frac{1}{2}$ inch in diameter, made of the finest hemp, while the mat-like surface closely resembles that common to all mats of the kind used for street doors. The texture of the mat is wonderfully close; and as the whole is treated with a waterproof composition, it may be regarded as practically impermeable to water. The hairy side of the mat is that applied to the ship's side, and it is stated—and we see no reason to doubt the statement—that these mats may be dragged over jagged edged holes in iron plates without sustaining any injury.

Pneumatic Pontoons.

Knapp's open-bottom pneumatic jacks or pontoons are attached by chains passing under the wreck, and the chaining is ingeniously effected by means of a small tube passed under the wreck, through which a float and line attached to the cable is drawn. Compressed air is then admitted to the pontoons, which instantly give the lifting power. The advantages of this system consist in easy management and the possibility of being used in exposed situations; and it appears to be extensively patronized.

French Patents.

In 1874 there were taken out in France 5,746 patents: 4,202 for fifteen years, 54 for ten years, 32 for five years, 283 foreign patents, and 1,175 extensions of former patents. The objects for which patents were taken out were in the following order for number: Chemical industry, including foods and drinks, machinery, textile industry, agriculture, domestic appliances. The average number of patents per annum in the ten years before the Franco-Prussian war was 5,800.

Donkey Street Cars.

A little girl, daughter of an American officer now in the service of the Khédive, Egypt, writes home that they use passenger donkeys in the city of Cairo, instead of street cars. The donkeys are not much larger than good sized dogs. If you wish to ride, you straddle a passing donkey; the Arab driver follows and, when you get off, collects your fare, then looks out for another passenger. Advantages: No crowding; plenty of air.

It is proposed in France, by the telegraphic administration, to encourage the introduction of private wires, and to offer such inducements that no great factory and no rich man's house in the country will be without its wire.

CAVENDISH showed that nitrogen and oxygen in air formed a mixture only, but that the passage of electric sparks produced their chemical combination—nitric acid being the result.

COMBINED HAND AND SLIDE LATHE.

We illustrate herewith a very useful combination lathe, constructed by Messrs. Low and Duff, of Dundee, Scotland, and exhibited by them at the recent Exposition at Manchester, England. The tool is specially adapted, says *Engineering*, for small brasswork, etc., and it is fitted with a reversing motion for tapping.

In Fig. 1 the tool is shown as arranged when fitting the key or plug of a gas joint with the slide. This operation having been performed, the set screw, A, is loosened, and the slide moved on the circular table to the back of the lathe, the hand rest being brought round into the position which the slide occupied. The barrel of the joint is then put on, the hole drilled and tapped at the end for the small screw, and the piece of work finished without being taken out of the chuck. The slide is so mounted that it can be readily set to any desired taper, and the table on which the slide and hand rests are mounted is moved up to a stop, so that, when the slide is once set to any desired angle, it can be moved out of the way and brought back again without requiring further setting, so long as the same class of work is being gone on with.

For work which requires to be mounted between centers, a loose head is provided, this head being shown swung down out of the way in Fig. 1, but in use in Fig. 2, where the plug of a large cock is being operated upon. Altogether this machine is a very compact and handy one, and it appears capable of getting through a large quantity of work.

Hypodermic Injection of Nutritious Substances.

Dr. Krüg, a physician in a private lunatic asylum, gives an account of a trial of this which he has recently made.

C. E., aged fifty-seven, a Hungarian proprietor, has been in an asylum at Ober-Döbling since 1868, and for the purpose of suicide had often refused all food, so that for twenty-seven months at a time he had to be daily fed by means of the tube; of late he has been more inconstant in his refusals, sometimes eating even abundantly, and at others allowing himself to be fed. On January 18, however, he began again to absolutely refuse food, and so continued, with the exception of one day, to the 24th, when it was resolved to feed him by the tube as heretofore; but all attempts to pass this proved fruitless, such violent coughing and irritation did it cause, so that the patient became breathless and cyanotic. Even when the tube was got into the stomach, the fluid injected was immediately expelled again by its side; so that the whole procedure, inducing so much suffering, proved useless. As ten days had elapsed without his taking any food, with the exception of some soup once, it was resolved to try the subcutaneous injection, under the hope that a slight quantity of nutriment might be so supplied, so as to ward off danger to life and perhaps exert a favorable impression on the patient when he found his resistance unavailing. Olive oil was the substance injected, the syringe employed holding 0.9 cubic inch. To the syringe was attached a thin caoutchouc tube, terminated by the canula of an ordinary subcutaneous syringe, so that the movements of the patient did not derange the working of the apparatus. One or two syringes full were injected daily, being from 0.9 to 1.8 cubic inches of oil. At first each syringe-full was thrown into five apertures, but afterwards into three, or even only two. The oil passed, drop by drop, out of the canula, so that at first an hour, and afterwards half an hour, was occupied in the emptying of each syringe. This slow procedure rendered the injection painless, and prevented reaction, which, as well as pain, was caused when the injection was made too rapidly, or too much fluid thrown into one spot. Most of the injections were made in the foot, some in the belly, and others in the sides. Some effect was produced upon the patient's moral condition, so that he partially abandoned his opposition to food. Thus, during thirty-nine days, he completely fasted during nine, ate voluntarily during ten, and was supported by the injections during the other twenty. It was not possible to weigh him, but his general appearance was not changed for the worse. With some occasional exceptions, when the injections were resumed, the patient gradually abandoned his resistance, and at last ate in a natural way, the experiment lasting altogether about two months. The chloroform odor,

characteristic of fasting persons, disappeared soon after the first injection.

Salt for Domestic Animals.

Salt is not only a mild aperient or deobstruent, but it operates, to some extent, as a tonic. It is a very great rectifier of the acidity of the stomach when taken in proper quantities; and it not only renders very palatable food which would be disagreeable and insipid without it, but it keeps the functions of the stomach in a healthy state and often alleviates

are kept in pasture where there is much clover (*trifolium pratense*), they usually have a great hankering after salt; and if they can have access to it, they will go and lick, more or less, several times during the day; and they will consume just enough to rectify the acidity of the stomach, and keep them from bloating. Many a farmer has lost a fine animal, in consequence of bloating, which one pound of salt would have kept in good health.

High Speed Brake Trials.

In consequence of a statement made by one of the principal officers of the Midland Railway Company, England, with reference to the collision at Kildwick, to the effect that the engine driver of the mail train would have been able, with the means at his disposal, if traveling at the rate of 50 miles per hour, to stop his train in 400 yards, certain brake experiments were lately made in the presence of Captain Tyler, on the Derby, Castle Donnington, and Trent line. There were four trials. In the first of these experiments all available means were used to stop the train, namely, tender brake and one guard's van brake at rear of train applied, sand used, and engine reversed and steam against it, with the Le Chatelier tap open. The gradient was level; the train, the total weight of which was 102 tons 7 cwt. 2 gr., was running at the rate of 49.9 miles per hour when the brake was applied. The result was that 54 seconds were occupied in stopping the train, which, after the application of the brake, ran a distance of 807 yards. In the second experiment all available means were used except reversing the engine; gradient 1 in 330 up and level, speed 49.9 miles; time occupied, 60 seconds; distance run, 843 yards. In the experiment all available means

were used, and when the engine was reversed, the regulator was allowed to remain wide open all the time; gradient, 1 and 230 down, speed, 53.5 miles; time occupied, 55 seconds; distance run, 867 yards. In the final experiment all available means were used. When reversing the engine the steam was first shut off, then the lever pulled into back gear, and then steam was turned on again as in first experiment; gradient, level; speed, 52.5 miles; time, 50 seconds; distance run, 787 yards. The weather was fair, and the rails slightly greasy. Captain Tyler, in his report to the Board of Trade, states that the engine driver of the mail train, who at present awaits trial on a charge of manslaughter, could not have acted so promptly as those who, on the experimental train, listened for the word of command. He adds that, instead of 400 yards, 800 yards should have been stated as the distance in which, with the assistance of the guard, he could have stopped his train. From this it appears that, at almost 50 miles an hour velocity, a train will run nearly half a mile after the brakes are applied.

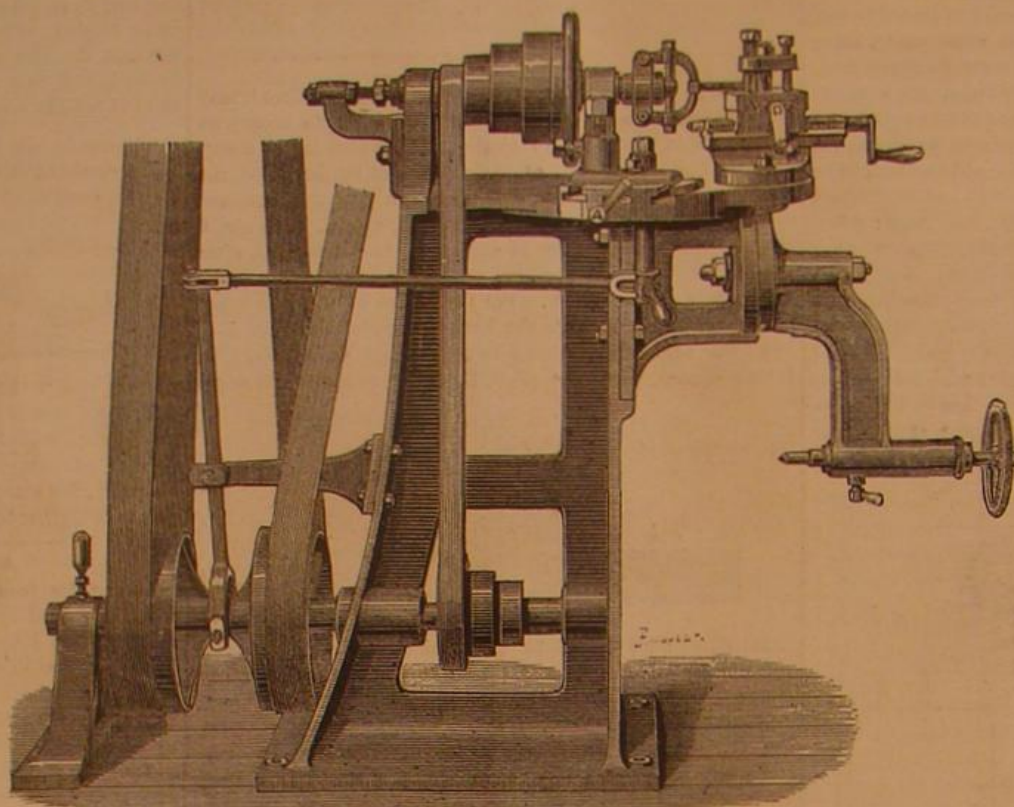
Dotted Pens.

An ingenious little apparatus for assisting in mechanical drawing, has been patented by its inventor, E. O. Richter, a watchmaker in Chemnitz, Saxony. In machine drawing, projections, and the like, the drawing of dotted, half dotted, or stroke lines is a mechanical task, the wearisomeness of which this apparatus is designed to relieve. An upright plate, sliding on the paper, has on its lower edge a toothed wheel catching in a bent lever which carries the pen point. A spring keeps the pen close to the paper. The wheel is kept in position by an adjustable plate. Wheels of various patterns can be used for producing a mixture of dots and strokes, the length and variations of which correspond to the indentations on the circumference of the wheel.

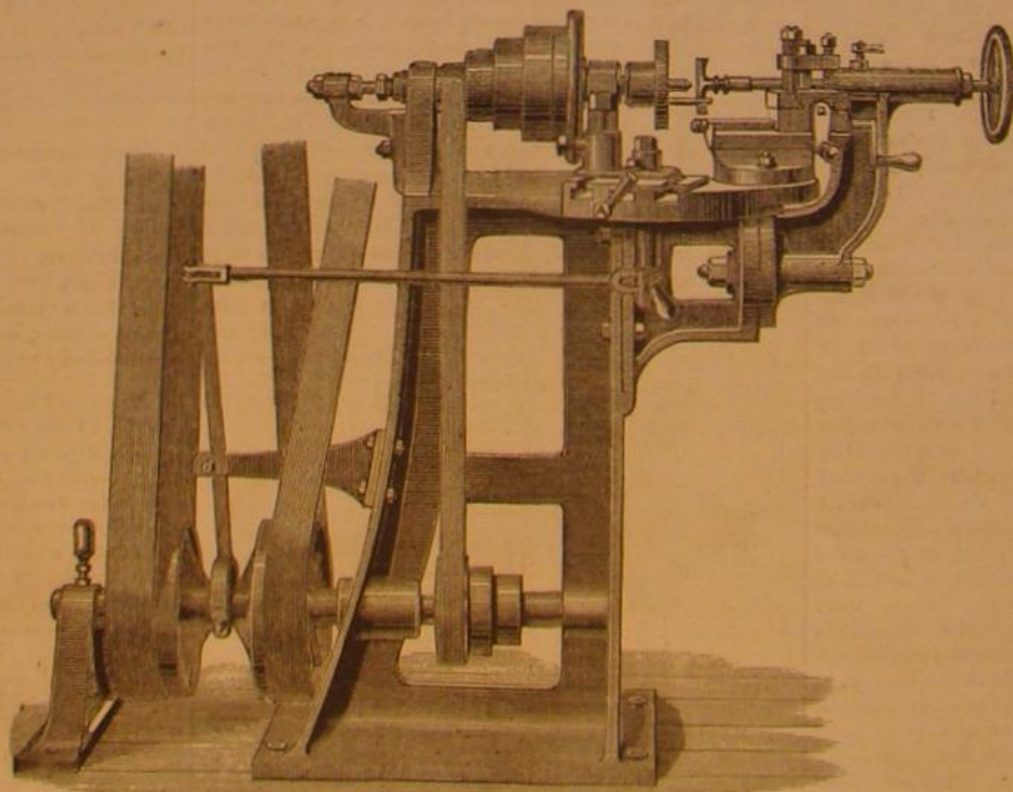
Nickelization.

In Plazanet's process a bath is used of 875 parts sulphate of nickel, 20 sulphate of ammonia, 17 citric acid, and 1,350 of water. A bath much used in France is formed of a solution of 4 parts of nitrate of nickel in 4 of liquid ammonia, and 150 water in which 50 parts of sulphate of soda have been dissolved. Using a moderate weak current the operation is at an end in a few minutes. There is no need to interrupt it by taking the objects out and brushing them. When the film of nickel is of sufficient thickness, the objects are withdrawn from the bath and dried with sawdust.

SHINGLE roofs can be made doubly durable by giving them a coat of thin oil before they get wet.



IMPROVED HAND AND SLIDE LATHE.—Fig. 1.



IMPROVED HAND AND SLIDE LATHE.—Fig. 2.

a pail, or small tub, leaving one side only, so that they can thrust their heads separately into it. For cattle and horses, encircle the tub with a lot of boulders as high as the top of it, or drive a half dozen strong stakes around it, letting them extend above it a few inches, to protect it from being pawed to fragments. If the tub is watertight, in case it should rain in it there will be nothing lost, as they will lick the salt water as readily as they will the salt; and should the water evaporate, the salt will remain. When sheep or neat cattle

THE ANTELOPES.

Among the widely extended family of deer, the tribe of the antelopes is especially worthy of attention. The name is generally considered to be synonymous with grace and beauty; but the race is so varied by climate and locality that some of its members resemble the horse in size and the goat in configuration, while others are wild and untamable. The sable antelope, for instance, has horns three feet long; it is exceedingly handsome, being quite black on the back and sides, and white on the belly. The gemsbok is a very fierce animal, defying even the African lion to combat; and thegnu (called *wildebeest* by the Dutch settlers of the Cape of Good Hope, its native place) has the appearance and gait of a horse. The largest antelope is the *nil ghau*, which much resembles an ox; and closely allied to it is the beautiful eland, which has been domesticated at Moor Park, England, and is a very handsome creature in the fields. It fattens well, and is most excellent beef. The smallest antelope is the madoqua (*antelope saltrara*), the most diminutive of horned animals, scarcely larger than a rabbit.

But for beauty the gazelles must be allowed to carry off the palm. This genus varies in different countries, those of Egypt and Asia being well known for their gentle docility. They are the favorite domestic animals among most oriental nations. Their eyes are mild and lustrous: "brightly bold and beautifully shy," as Byron well describes them. Our illustration shows the brown Indian antelope, one of the tallest of the genus, and remarkable for its fleetness. Its legs are finely formed and exceedingly muscular, and the body has no superfluous weight on it; and it is very strong in the lumbar regions and the hind legs. There is little doubt that many species of antelope could be domesticated in this country. In summer they would be sure to thrive, while a little care in winter would protect them from the inclement weather, and the trouble would be amply repaid by the beauty of the denizens of the park and paddock.

THE SAMBUR.

The sambar or rusa deer (*rusa Aristoteli*), found in most of the large jungles surrounding the hill ranges throughout India, is considerably larger than the Scotch red deer, and more powerfully built. A full grown stag averages from 14 to 15 hands at the shoulder, and his hind quarters are as well shaped as those of a high caste arab, whereas the Scotch red deer generally falls off low behind, and is more or less cat-humped. The head is beautifully formed, the forehead being broad and massive, while the line of the face is straight and the muzzle very fine. The eyes are very large and beautiful, being fringed with long black eyelashes, and the sub-orbital sinus—which is very conspicuous—expands greatly when the animal is excited. The horns of the sambar vary very much in their development, according to the district in which they are found, some being long and slender, while others are massive and short. The horns are rather upright, having two short brow antlers only, and at three years old two points at the extremities of each beam, as shown in the engraving. Sometimes the inner and sometimes the outer line of the terminal

fork will be found the longer; and occasionally, but rarely, three tines are seen at the summit of the beam. The horns of a mature stag average 35 inches in length from base to tip, having a circumference of 11 inches round the burr at the base, and 8 inches at the thinnest part of the beam; but some antlers greatly exceed these dimensions. The color varies slightly, but is usually of very dark slate mingled with gray, nearly black about the face and points, and a light buff between the haunches and underneath. The hair immediately next to the jaw is longer than on any other part of

the neck; and when the animal is alarmed or excited, it stands on end and forms a kind of ruff, sometimes called the mane. The hinds are smaller than the stags, and of a lighter color; and both sexes have canine teeth in the upper jaw.

Old stags, during the rutting season, in October and November, are extremely vicious, and may be heard all over the forest, calling to each other. When they meet they engage in savage conflicts, sparring with their fore feet and butting each other with their antlers, like the American deer.

Wagner's Free Institute of Science.

This institution, situated at the corner of Montgomery

interested in. At the first meeting, there were over a thousand in the audience, while many were unable to gain admittance.

Economy in Use and Manufacture.

How to save in cost of manufacture is thus suggested by James C. Baylis in a paper before the New York Society of Practical Engineering:

"We are very near the maximum of economy as regards the cost of power. We can build boilers that will evaporate ten pounds of water for every pound of coal burned under them; and when it is attempted to economize still farther, it is found that the interest upon the increased cost of the boiler amounts to more than the value of the coal saved. It is doubtful if any important improvement is possible upon the Corliss engine gear, or the Cornish catcract double-head valve. Steam jacketing has not yet, in this country, received the attention to which its importance entitles it; and with this, and in clothing with felt and other non-conducting substances, there is room for profitable experiments. For the next half century we must look to economy in little things for the cheapening of the cost of manufactured products.

Among the attainable economies not generally carried to their ultimate application, the saving of fuel is the most prominent, and it is one of the most serious drawbacks to our industrial prosperity. Waste of fuel results mainly from bad firing. In an experiment made with different men, each with the same amount of fuel, the best man ran the engine 56,000 revolutions, and the poorest 28,000 revolutions. A few years ago, the best engine-driver in Great Britain, and who was always in request at competitive trials, was a lad 13

years of age. This boy could run an engine longer with a given amount of fuel than any other engineer in the country, and the fact is suggestive. The next, after economy in the cost of power, is the task of economizing skilled labor. An important plan is to employ unskilled labor to supplement skilled artisans. The proper care of tools is always attended with an important economy. In small establishments this seldom receives due attention. As a rule, a tool belongs to whoever happens to have it. Consequently, no one is responsible for it. There is great waste of lubricating oil; and above all, in our manufactories, time and material are wasted for want of proper system. System should begin with the building of the shop. If we can bring ourselves to take care of the small economies, the great ones will take care of themselves."—*Paper Trade Journal*.

Utilizing Cobwebs.

Cobwebs have been applied to various uses. The delicate cross hairs in the telescopes of surveying instruments are fine webs taken from spiders of species that are specially selected for their production of an excellent quality of this material. The spider, when caught, is made to spin his thread by tossing him from hand to hand, in case he is indisposed to furnish the article. The end is attached to a piece of wire, which is doubled into two parallel lengths, the distance apart exceeding a little the diameter of the instrument. As the spider hangs and descends from this, the web is wound upon it by turning the wire around. The coils are then gummed to the wire and kept for use as

required. About a century ago, Boa of Languedoc succeeded in making a pair of gloves and a pair of stockings from the thread of the spider. They were very strong, and of a beautiful gray color. Other attempts of the same kind have been made; but Réaumur has stated that the web of the spider was not equal to that of the silkworm, either in strength or luster. The cocoons of the latter weigh from three to four grains, so that 2,304 worms produce a pound of silk; but the bags of the spider, when cleaned, do not weigh above the third part of a grain.—*Appleton's Cyclopædia*.



THE BROWN INDIAN ANTELOPE.

avenue and 17th street, Philadelphia, was founded and endowed by Professor William Wagner, formerly the confidential manager of Stephen Girard, and was incorporated in 1855.

In the large lecture room of the Institute, there are delivered, nightly, free lectures upon scientific subjects; while at the monthly meetings, recently inaugurated, there are presented exhaustive reports of progress in science and the arts, besides practical exhibitions and explanations of recent and meritorious novelties of interest, machinery in motion, etc. The programme for the autumn course of lectures is as follows: Mineralogy, William H. Wahl, Ph.D.; Physics, Professor J. Child; Anatomy and Physiology, C. C. Vanderbeck, M.D.; Botany, Henry Leffman, M.D.; Philology, R. Grimshaw, Ph.D.; Elocution and Oratory, Professor J. W.



THE SAMBUR AT BAY.

Shoemaker, and others. The monthly meetings are in charge of Dr. Wahl and Professor Grimshaw. At the initiatory meeting, there were presented to the public, for the first time in Philadelphia, the Brayton ready motor, the National Timber Preserving Company's new process (shown on a huge log), and some dozen other interesting novelties. Drs. Wahl and Grimshaw are desirous of hearing from inventors, producers, and manufacturers throughout the country, who are thus offered an excellent opportunity of bringing before a large and practical audience whatever novelty they may be

A NEW CHROMATROPE.

BY PRESIDENT HENRY MORTON, PH. D., STEVENS INSTITUTE OF TECHNOLOGY, ROBERSON, N. J.

There are a number of phenomena, related more or less to that illustrated by the seven-colored rotating card known as Newton's disk (phenomena, in other words, involving the composition of colors and persistence of vision) which it would be desirable to illustrate by means of a transparent apparatus and a magic lantern, rather than by an opaque disk of large size viewed directly. In fact, for twenty years or more, Duboscq has been making several chromatropes of this character. One of these consisted of a Newton's disk made of sectors of colored gelatin, mounted between two thin disks of glass, which were rotated by a small central pulley, over which passed a barrel moved by a large driving wheel. Another consisted of two disks so painted as to produce by their opposite motion the appearance of undulatory movements in certain spots of light. These were driven by a cord carried continuously round the driving pulley and both the device disks. This chromatrope, when rapidly moved, developed by persistence of vision a figure of luminous chainwork, in a way which illustrated the phenomenon of persistence of vision very satisfactorily. Another of these chromatropes illustrated Faraday's observation of the toothed wheels rotating in opposite directions. While all of these were good of their kind, there yet remained something to be desired, as regards rapidity of rotation, solidity of machinery, and clearness of vision.

Wishing to employ many of these and other illustrations at a lecture on color which I delivered at the Academy of Music in Philadelphia, I applied to Mr. George Wale, of the firm of George Wale & Co., instrument makers to this institution, and he made for me the instrument which I have found very admirable in its effectiveness and durability, and will now describe.



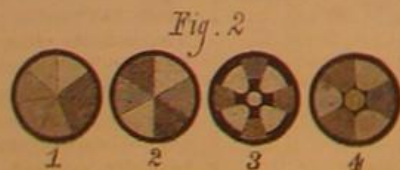
Fig. 1 shows the arrangement of parts, with an addition to be presently described.

The large wheel, A, is made of brass, with a rectangular groove on its periphery, into which is sprung a flat ring of thick sheet rubber. This gears by friction into the smaller part of the pulley, D, and this gives to it a high velocity. C is a handle and H the axis, clamped in a slot in the frame so that it can be brought nearer to D to increase the driving friction.

The chromatrope disk rests on the larger part of this same pulley, and also on the other two pulleys, D and N. It is thus readily driven at a high speed by its edge, the grooves of the pulleys in which it rests being covered with thin sheet rubber.

The entire field of the chromatrope is thus clear and unobstructed by any belt, pulley, or the like. In order readily to change the design disk of the chromatrope, the pulley, N, is held by a spring and can thus be pushed back so as to release one disk and admit another.

The design disks used in this apparatus may be multiplied indefinitely, but those at present supplied are the following:



1. Newton's color disk. This consists of seven sectors, red, orange, yellow, green, blue, indigo, and violet respectively. This and the other color disks are made of pieces of stained glass, cemented with Canada balsam to a disk of plate glass, and so admirably fitted that the effect on the screen, even, is of the most perfect finish. Their richness, regularity, and accuracy of color surpass anything which has ever been produced by painting.

2. Disk illustrating Young's theory. Six sectors of red, green, and violet are here arranged, and when rotated they produce white.

3. Disk illustrating Young's theory, Professor Rood's design, showing that green and violet produce blue. This consists of various partial sectors, arranged as shown in the accompanying engraving, Fig. 2, third circle. Here we have a number of sectors, of which the large are colored green and the smaller violet. The shaded portions are black. When such a disk is rapidly rotated, we have on the outside a ring of green, so far as to the portion where the violet sectors begin; then we have a ring where both green and violet occupy the field in succession, and thus by persistence of vision blend and give their resultant impression; lastly, where the green sectors end, we have a circle of simple violet. In the case of this disk, the combined color obtained by the union of the green and violet is a light sky blue.

4. Disk illustrating Young's theory, Professor Wood's design, showing that red and green produce yellow. This is arranged on exactly the same principle as the previous one, except that the smaller partial sectors are made of red glass in place of violet.

5. Disk illustrating the fallacy of Brewster's theory, Professor Rood's design, showing that blue and yellow do not produce green. See Fig. 2, fourth circle.

This resembles the foregoing, except that the eight sectors are entire, and consist alternately of blue and yellow glass, and when rotated produce white light.

6. Disk illustrating persistence of vision, being the present writer's design of the chameleon top.

This is shown in position in Fig. 1. The disk, E, is of hard rubber, with an opening eccentrically placed, over which is supported, between three small pulleys, L, the glass device disk, B R.

If, while this disk is rapidly rotating, the finger is made to touch lightly the little wheels at a single point of their revolution, it will cause them to move slightly so as to rotate the device disk, B R W, very gradually. This is placed, as we have seen, eccentrically to the large disk; and having on it the irregular design shown in Fig. 3, in which R is red glass, B blue, and W white or transparent, it will, by the slow rotation described, have one color after another shifted into the center of rotation of the large disk, and also the combination of colors in circles outside of the center will be changed. Thus: Suppose, in the first case, that the position

Fig. 3.

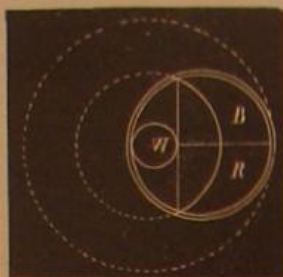


Fig. 4.



of the disks is indicated by Fig. 3, the largest dotted circle representing the large disk, and W, B, and R being the white, blue, and red parts of the device disk. In this case the white occupies the center of the large disk, and thus the rotation of this leaves the portion included in the small central circle always white. Outside of this, however, it is evident that, in the ring between this smallest circle and the next one, white, red, and blue will be carried in succession by the rotation of the large disk over the field, and thus, by persistence of vision, a blending of these three will occupy this ring-shaped space. Moreover, since the proportion of the colors will vary concentrically, this will not be a flat, but a shaded ring. Thus, just beyond the smallest circle white will predominate, while just inside the next circle there will hardly be any white.

Again, between this second circle and the outermost, there will be a similarly graduated ring, red and blue with no white.

Now suppose the small disk to rotate so as to shift the red portion into the center of the large disk, as shown in Fig. 4. Here evidently, when the large disk rotates rapidly, we shall have, by persistence of vision, a red center within the small circle; between this and the next circle a ring of combined red and blue; then a narrow ring of red, blue, and white; then a broad graduated ring of blue and white.

The shifting of the center is of course accomplished gradually, and thus the figure on the screen passes imperceptibly from change to change in countless variety, and with a beauty of effect that hardly admits of description. The prominent idea suggested to most is that of an ever-opening and changing morning glory, or of a fountain of light and color, from whose center wells out a succession of colored waves, chasing each other outwards until they are lost on the margin of the basin.

At the suggestion of Professor C. A. Young, of Dartmouth College, a further development was given to this chromatrope. The pulley wheel, D, in place of having one groove to drive the glass disk it drove. The other pulleys, D' and H, were each made of two independent wheels.

Two disks, being placed in this arrangement, would therefore rotate in the same direction with high but slightly unequal velocities, so that one would, as it were, travel slowly over the other. The inner one of these disks was painted with a design, and the outer made part black and part white (that is, clear). The clear part, exposing in succession different parts of the design, produced corresponding changes in the persistence-of-vision figure developed. The simplicity of the means by which this result was obtained is a very admirable characteristic of the plan.

Other designs have been made by Professor MacCord, of the Stevens Institute, for driving disks in opposite directions, and indeed this fundamental idea of Mr. Wale, of driving the device disks directly by friction on their edges, seems to open the way for quite a number of developments of this piece of apparatus.

Cleansing Goods by Naphtha.

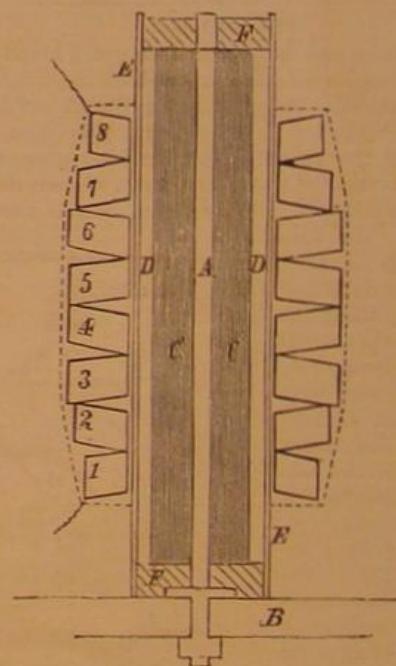
Naphtha is being used as a cleansing agent for furniture, carpets, clothing, etc., at an establishment recently opened in this city. The process consists simply in placing the article to be cleaned in a bath of the hydro-carbon and there leaving it for a couple of hours. Huge vats are used, capable of holding several barrels of naphtha at a time; and in these, sets of furniture or rolls of carpet are secured so as to be entirely submerged in the liquid. No preparation of the goods is necessary, and the naphtha seems to exercise no deleterious

effect upon varnish or gilding, upon glued joints, or upon the finest silk or satin fabrics. Dirt and grease are entirely eradicated, the latter sinking to the bottom of the vats, from which it is from time to time removed in the shape of a thick yellowish mass. Moths are of course totally destroyed.

Several fine sets of furniture were shown us, which had been treated by the naphtha process. They appeared like new so far as the fabrics were concerned, and there was no discernible smell of the fluid. The process is patented. The principal item of expense is the evaporation of the naphtha; but this being allowed for, the cost of cleansing is somewhat less than that incurred in the ordinary method followed by the clothes-scouring establishments. It may be added that naphtha does not act upon linen or cotton, and is practically available only upon animal fibers.

A NEW INDUCTION COIL.

Mr. C. F. Brush, M. E., communicates to the *Engineer and Mining Journal* a description of a novel induction coil designed by him, an engraving of which, in section, we give here with. The three eighths inch iron rod, A, is secured by a collar and nut in the base, B, and serves as a support for the core, C, which is composed of about 1,200 iron wires (No. 20 gage) made perfectly straight and carefully annealed. This core is covered by four layers of paper saturated with paraffin, then one layer of the primary wire, D, which is of copper one eleventh inch in diameter and 90 feet in length, then six layers of paper, and, finally, the second layer of wire. The latter is not covered but is wound with a narrow strip of paper between the consecutive turns, the object of this being to economize space. A hard rubber tube, E, incloses the primary wire, and is 12 inches long, 2 1/4 inches in internal diameter, and 1/2 inch thick. It is held by the pieces of wood, F, which also support the core. The secondary wire is 30,000 feet in length, is wound in eight sections, 1, 2, 3, 4, etc., and covers 8 inches of the tube, as shown. Sections 1 and 8 contain 35 layers of wire each; sections 7 and 2, 55 layers each, and sections 3, 4, 5, and 6, 67 layers each. This arrangement places most wire around the middle portion of the core, where its inductive force is greatest. The consecutive layers of wire in each section are insulated from each other by ten thicknesses of unsized paper saturated with melted wax; and the consecutive turns of wire in each layer are insulated from each other by being wound with a space of one two-hundredths of an inch between them. The wedge-shaped space between the sections is filled with paraffin, which insulates them, and the exterior of the sections is also covered with the same material, until the shape of the apparatus becomes as shown. The secondary wire begins with section 1, and forms the outside layer first; thence it passes from layer to layer until the innermost one is reached, there it crosses over to section 2, where sections 1 and 2 touch each other, and forms the innermost layer of section 2, thence from layer to layer until the outside one is reached; thence it passes to section 3, forming the outside layer first, and thus it proceeds until it ends in the outside layer of section 8.



The advantages of this arrangement, as regards economy of space, is obvious. No insulating material being required between the sections, where the wire passes from one to the other, none is used. But as the quantity of wire, and consequently the tension of the induced electricity, increases directly as the distance from this point toward the opposite edges of any two contiguous sections, so the thickness of paraffin increases until finally it is thickest of all where insulation is most needed. A space of one eighth of an inch between the innermost layer of the sections and the tube, D, is filled with melted paraffin, which, together with the rubber tube itself, forms the insulation between the primary and secondary wires.

The object in using the secondary wire bare is economy of space. It is a matter of the greatest importance that the whole of the secondary wire be placed as near as possible to the magnetic core, E, as the inductive force of the latter varies inversely as the square of the distance from its axis. The same amount of silk covered wire would occupy at least double the space, and would, consequently, average a much greater distance from the core.

The condenser used with this coil consists of two hundred and forty sheets of tinfoil, five by ten inches, arranged in the

usual manner, and separated by single sheets of varnished paper. The break piece is Foucault's automatic, in which the rupture of the current occurs at the surface of mercury covered by a layer of absolute alcohol. It is operated by a separate electro-magnet, which, however, is in connection with the primary wire of the coil. The instrument is provided with a communicator by which the primary current is started, stopped, or reversed at pleasure.

The performance of this coil is quite extraordinary for an instrument of such small size. When operated with two cells of Bunsen's battery, it gives sparks three and a half inches in length; and with one large cell of the Grenet battery, three inch sparks are obtained. The sparks are very dense, and are attended with numerous and brilliant ramifications.

DECISIONS OF THE COURTS.

United States Circuit Court.—Eastern District of Michigan.

PATENT HOTEL REGISTER.—CHARLES L. HAWES vs. WILLIAM W. ANTIPOLO. [In equity.—Before Longyear, J.—February, 1875.]

In order to defeat a patent on the ground of want of novelty, the proof of prior use or previous knowledge must be such as to establish the fact clearly and satisfactorily, and beyond a reasonable doubt.

Where the proofs are contradictory, more preponderance is not sufficient to sustain the allegation. The preponderance in such case must be such as to remove all reasonable doubt.

To doubt in such a case is to solve the question in the negative. Letters patent No. 63,889, for a new and useful Hotel Register, granted to Charles L. Hawes, April 16, 1867, sustained.

The invention in question is what is commonly known as the "advertising hotel register." The book being constructed so as to have inserted advertisements at the top and bottom and on the margin of each page, with a blank space for the registering of names of guests, or on each alternate page, leaving the opposite page blank for registering of such names, or on both pages of each alternate leaf, such leaf being sometimes made of bibulous or blotting paper.

The proofs showed that the complainant perfected his invention and put it into practical use as early as in May, 1866, and it was to that date the proofs as to prior use and previous knowledge related.

No advertising hotel register book purporting to antedate complainant's invention was put in evidence. Such a book, duly verified, would be the best evidence possible. Each page would be an intelligent speaking unimpeachable witness to its own chronology, and the book itself the best evidence of the date of its use. The case is left to stand exclusively upon the recollections of witnesses, and at a distance in time from eight to twenty years, and unaided in any single instance by any contemporaneous memorandum or writing whatever. I shall recur to this peculiar aspect of the case in another part of this opinion.

The places where and the persons by whom such prior use and previous knowledge are alleged to have taken place, and as to which proofs have been made, will be taken up in the order in which they were alleged in the amended answer.

1. Prior use in the Exchange Hotel at Sturgis, in the State of Michigan, by E. W. Pendleton.

Pendleton, with five others, testify to the use of an advertising register in the hotel named prior to May, 1866, namely, in 1864 and 1865, and nine witnesses testify to the contrary. That registers of some kind were used in that hotel during the years 1864 and 1865, and that advertising registers were used in it after May, 1866, the testimony on both sides is entirely agreed. The vital question is whether the registers used in 1864 and 1865 were advertising registers, or what is the same thing, whether the conceded use of advertising registers commenced in that hotel before May, 1866.

As to this question, the testimony is in direct and irreconcilable conflict. The testimony was taken at a distance of time of from eight to ten years. The witnesses on both sides testify from memory alone, unaided by any memorandum or writing whatever of the fact itself, or of concurrent facts. The uncertainty of memory as to dates, under such circumstances, is well understood; and where, as in this case, the event in question was one not calculated to fix itself in the memory of the persons called to testify, except Pendleton, on account of any interest it was to them, and those persons have equal means of knowledge, are of equal credibility, and apparently of equally sound memory, and they positively disagree, it may well be said, in a case like the present, that prior use is not made out in that clear and satisfactory manner requisite, as we have seen, in such cases.

2. Prior use in the Michigan House, at Tecumseh, in the State of Michigan, by Mrs. W. H. Hoeg.

Four witnesses testify to the use of an advertising register at the place named in 1855, and five, including the then clerk or manager for the proprietor, George R. Southworth, testify to the contrary. Southworth certainly had better means of knowledge, and would be more likely to remember what the fact was, than any of the witnesses testifying to such use at the date mentioned, except perhaps the witness Spafford, who testified that he, being a binder, procured the printing done and himself bound the book and put it into use there while he was in charge of the hotel during a temporary absence of Southworth. But Southworth was absent only two or three months, and Spafford testifies that the register so put there by him continued to be used there after Southworth's return. So that if there ever was such a register at the time specified it was there when Southworth returned and resumed the management of the hotel; and he testifies positively that there was no such thing there. He describes what he says was the only book used in the office to his knowledge, and that was not an advertising register, or, in fact, a register at all as commonly understood. He describes it as simply a book in which the names of guests were entered by the clerk and a minute kept of what they had at the hotel. The other four of complainant's witnesses corroborate Southworth both as to the fact that no advertising register was used there during the time mentioned by Spafford and as to the description of the book that was used.

In such a conflict of testimony perhaps nothing more need be said than that the case is such that there is such a want of clear and satisfactory proof of prior use and, to say the least, that it is involved in so much doubt that, under the rules laid down, it must be held that the allegation of prior use at Tecumseh is not made out.

The proofs showed that the hotel building in question was consumed by fire in 1858 with its contents. The absence of the register or book used there at the time specified (1855) is therefore satisfactorily accounted for.

3. Prior use in the Bentley House, at Dexter, in the State of Michigan, by Nelson J. Alport.

Alport, with eight others, testify to the use of advertising hotel registers in the place named prior to 1866, namely, in 1863, 1864, and 1865, and eight witnesses testify to the contrary. As in the instance of the alleged use at Tecumseh, so here, the hotel was destroyed by fire after the alleged prior use, and the two register books claimed to have been so used there are represented to have been destroyed with the hotel. So that here, as in both the preceding instances, the case is left to stand exclusively upon the recollections of witnesses as to both the fact and the dates, and in this instance at ten and eleven years distance of time.

The conflict of testimony is not whether there was or was not a register or book of some kind used at each of the hotels in question during the periods of time covered by defendant's testimony, for the witnesses on both sides are all agreed that there was; neither is it as to some of the places, as at Sturgis and Dexter, that there was or was not an advertising register used some time by the person named in a hotel kept by him, for as to this the witnesses are also all agreed that there was. The conflict is simply as to the description or kind of register so in use at such prior periods of time, and, in respect to Sturgis and Dexter, as to the time when they saw an advertising register in use there in a hotel kept by the persons named—whether in 1864 or from one to three years earlier. One set of witnesses testify in the one case that the register so used was an advertising register, and in the other case that it was at the earlier date the advertising register was used; and the other set describes the former as a plain register, and that the latter was used at the later date. Each set testify to an affirmative equally with the other, and neither has any advantage over the other under the rule laid down in *Kitt v. Hildekoper*.

Upon the whole consideration, it results that there must be a decree for the complainant according to the prayer of his bill.

Decree accordingly.

[J. J. Allen, W. W. Taylor, and E. C. Walker, for complainant.

Moore and Griffin, for defendant.]

Recent American and Foreign Patents.

NEW AGRICULTURAL INVENTIONS.

IMPROVED FLOW.

Irvin Freeman, Corpus Christi, Texas.—This invention relates to a shovel or subsoil plow, and consists of a hook rod attached thereto, and a lever having a pawl that works in a beam rack. This mode of fastening a subsoiler or shovel to a skeleton frame is found in practice to be very convenient, and a great labor-saving device.

IMPROVED HARROW.

William Frank, Mount Station, Ill.—This invention relates to certain improvements in harrows, and it consists in three equilateral triangular frames, constituting a sectional harrow in which the parts are capable of use either singly or collectively, and with either angle for the front. The invention also consists in the peculiar construction of the draft attachment and the means for coupling the sections together.

IMPROVED CORN HUSKER.

William Allen Dick, Clevelands, Ohio.—This is a kind of pod auger-shaped tool, with a pointed top a little in advance of the cutting lip arranged on a horizontal revolving axle, in combination with a sliding table to feed the corn ears up to the tool. The object is to remove the husks without the loss attending the old methods, and to leave them prepared for use without the stubs.

NEW CHEMICAL AND MISCELLANEOUS INVENTIONS.

IMPROVED CIGAR BOX.

Charles S. Brown, Baltimore, Md.—The object of this invention is to provide a cigar box better adapted to preserve the cigars from dampness, and so constructed as to allow the quality and brand of the cigars to be inspected without opening the box or breaking the revenue stamp. It consists in a tight sheet metal box, having its end walls slightly elevated and formed into beads, in combination with a glass cover contained into a suitable frame, which, when the box is to be shut, closes in between the said beads, which clasp and firmly secure the cover so as to render any other form of fastening unnecessary.

IMPROVED OPERA CHAIR.

Ira Chase, New York, and George M. Ball, Green Point, N. Y.—The new feature in this device consists in telescopic braces attached to the lower part of the support and to the edge of the seat. These fold back out of the way when the seat is turned up, and at the same time form a strong and durable support.

IMPROVED HUNTING JACKET.

Henry L. Daigre, Alexandria, La.—This coat contains the requisites for hunting, distributed in a neat and convenient manner over the body. In the skirts are game pockets, having side gussets and bottom nettings. Within the game pockets are separate pockets of smaller size for the empty shells. The game pockets have covering flaps, which may be thrown up and attached to buttons for exhibiting the result of the day's sport.

IMPROVED EGG CARRIER.

Wendelin Wels, St. Paul, Minn.—This inventor proposes to cheapen and simplify egg-carrying devices by doing away with the hinged covers or sheets which separate the horizontal trays and providing the lateral partition strips of the egg cells with broad bottom and narrow top extension pieces that serve to support the eggs in an equally secure manner.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED WAGON WHEEL SCRAPER.

Norton Sage, Pekin, Ill.—In order to keep the tires of wagon wheels free from sticky mud, in this invention there is provided a bent iron bar attached to the rear axle, and having at its outer end U-shaped scrapers, which accommodate themselves to the rim of the wheel, no matter in what position the latter may be.

IMPROVED SCROLL-SAWING MACHINE.

Jerome H. Plummer, Brooklyn, N. Y.—The new features in this machine are a reciprocating saw frame (attached to a table extension) and slotted arms above and below, which serve as guides for the frame. The extension has a curved arm, which supports a shelf for holding tools. The machine in general is compactly built and well adapted for foot power.

IMPROVED CHILDREN'S CARRIAGE.

Ernst Krueger, New York city.—This relates to a novel and ingenious construction of the body, which has a flexible bottom stretched by lazy tongs frames. The axles are similarly extensible, and the whole is adapted to be folded in its longitudinal axis so as to be conveniently packed for storage, etc.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

MACHINE FOR PACKING TOBACCO IN BOXES.

James B. Farrar, Cary, N. C.—This invention relates to an improved machine for filling and packing bags or packages of smoking tobacco. It consists in an intermittently revolving belt provided with seats in which the bag holders are placed, containing the bags and the bag shapes. As the belt revolves, the flared ends of the bag shapes pass beneath an automatic and adjustable feeding apparatus, which delivers into the bags a requisite amount of the tobacco. The bag holders and bag shapes then pass in their seats in the belt from the rotation of the latter beneath two vertically moving plungers, one of which settles the tobacco in one bag shape, while the other packs the tobacco in the preceding bag. At the same time that the packing plunger descends, two lifters automatically rise and withdraw the bag shapes, leaving the filled bags and bag holders to be removed, and the latter prepared for insertion at the other end of the belt.

IMPROVED CAR COUPLING.

John H. Johnson, Brooklyn, Mich.—The new feature in this is a fulcrumed side lever attached to a vertically swinging drawhead, which last may be set and worked at any height for coupling. There are also devices to prevent the escape or detaching of the links.

IMPROVED LEVER POWER.

Henry C. Bell, Edina, Mo.—A vibrating lever is provided with notches or sockets, adapted for receiving the links or chains which pass around the object to be raised. The lever is suspended and vibrates on a central pivot, so that the hoisting chains are alternately slackened and subjected to strain, each chain being shortened when slack. The operation of alternate slackening and straining is continued until the shortening of the chain has raised the object to the desired height. This application of power is utilisable in a large number of ways.

IMPROVED DEVICE FOR CHANGING SPEED.

Joseph W. Mead, Dupont, Ind.—Instead of the cone pulleys and belts now in use, a conically faced disk is proposed, located on the driving shaft that transmits the power by conical friction wheels to a similar conically faced disk of the shaft to be driven. The shaft of the friction wheels are hung to boxes of a sliding and spring acted frame, and the wheels are adjusted by suitable lever mechanism.

IMPROVED SEWING MACHINE.

Josiah Gilnes and Noel W. Stiles, Postville, Iowa.—The novelty here is a shuttle carrier mounted on a pair of cranks, and operated by a crank on the driving shaft in such a manner that the shuttle travels in a true circle without revolving on its own axis, and thus does not twist the thread. This invention is one of considerable importance to sewing machine manufacturers, and we would especially commend it to their attention. The effect of merely avoiding the carrier in a circular orbit, without revolving it, not merely avoids twisting the thread, but also saves friction and prevents noise. The mechanical device used is at once ingenious and effective.

IMPROVED TOBACCO-CUTTING MACHINE.

Augustus A. Hagen, New York city.—For cutting tobacco in a rapid and easy manner, this inventor suggests a new machine having a cutting knife, to which a diagonal shear cut is imparted by a compound slide mechanism.

IMPROVED NUT FASTENING.

Robert C. Watson, Maysville, Ohio.—An eye stud is formed on each end of one of the fish bars, to receive one end of a locking plate. Said plate has holes to fit over the nuts, and its other end is connected at the middle of the joint, where it meets another similar plate fastened to the other end of the fish plate. The two plates are fastened on the stud by a split key, so that they can be readily put on and taken off.

IMPROVED WINDMILL.

John Cook, Harlem, Ohio.—In this the crank-shaft bearing is connected to the horizontal beam which supports the machine in a simple and efficient way by means of stirrups or yokes. Another new feature is a joint in the beam for the tail vane to swing around out of the wind when it blows too strong, in combination with a weighted lever for keeping the vane in the wind.

NEW HOUSEHOLD ARTICLES.

IMPROVED FLUTING IRON.

W. F. Fisher and A. C. Brown, Bremond, Tex.—The invention consists in a hollow smoothing and glossing iron, in which a fluting iron is inserted, the latter being also hollow to adapt it to receive a heating block, so that the several parts may be, so to speak, nested, thus economizing space, material, and the cost of manufacture, and combining several implements in one.

IMPROVED CARRIAGE CURTAIN FIXTURE.

Daniel R. Knight and John M. Hipple, Waynesborough, Pa.—This invention relates to certain improvements upon the carriage curtain fixture for which letters patent No. 166,114 were granted July 27, 1875; and it consists in the improved construction of the roll, the method of attaching the curtain thereto, a stop device for adjusting and regulating the height of the curtain, and the means for fastening the sides of the curtain.

IMPROVED LANTERN.

Patrick J. Clark and Joseph Kintz, West Meriden, Conn.—A yoke attached to a metal cap above the globe holds the latter to the lantern, while allowing said globe to rise and fall. There are new devices for concentrating the air on the flame, and for the ready admission and securing of the burner. The invention is quite simple and easily constructed.

IMPROVED PAN.

John C. Milligan, South Orange, N. J., assignor to Lalanc & Grosjean Manufacturing Co., New York city.—The object here is to enable pans to be made of thinner and lighter metal than is ordinarily the case, without detracting from the wearing quality, and also to increase the capacity of the utensil. The middle portion of the bottom has a downward deflection, and, on the part outside of this, legs or studs are attached.

IMPROVED FOLDING CRADLE.

John Welch and John Jefferys, New York city.—The bottom of the cradle is hinged to one side so as to turn up. The ends are each made in two parts hinged together, and are also hinged to the sides. The rockers are pivoted at one end, and secured at the other by movable pins. With this construction the cradle may be folded so as to require but little space, and be compact in form.

IMPROVED CURTAIN FIXTURE.

Rudolph J. Pospisil, Chicago, Ill.—This is a curtain roller turning in spring brackets, bearing on its ends, and having cords wound in opposite directions around each end, to raise and lower the rollers. The cords are guided in front hooks of the brackets. An illustrated description will be found on page 306 of the present volume of the SCIENTIFIC AMERICAN.

IMPROVED STOVE.

Robert S. Bostwick, Jackson, Mich.—The air passes upward between the fire pots, from side channels into an air chamber, and then mixes with the smoke and fire gases from one fire pot. The sheet of air that is thus supplied to the top of the fire produces the more thorough combustion of the fuel and a higher degree of heat. The unconsumed smoke and gases of combustion are conducted by suitable passages downward to pass between cap and fire pot, and then in upward direction to the chimney.

IMPROVED FOLDING CHAIR.

James H. Bean and Richard W. Box, Pulaski, N. Y.—In this chair the seat, which is pivoted to the back part, and the hind legs slide between the front legs for folding. The hind legs rest by projecting side lugs on the front legs, when the seat is thrown in position for use. This is a simple and strong article, easily packed and well suited for camp use.

IMPROVED CURTAIN FIXTURE.

George C. Mathers, Louisville, Ky.—This invention is an improvement upon that for which a patent was granted to the same inventor February 16, 1875. The improvement consists chiefly in arranging on the same axis both the friction pulleys over which the cord passes, and in locating them above the grooved pulley which is attached to the end of the curtain roller. The result is an economy in the construction of the fixture, and the cord is brought nearer the wall or window casing, thus rendering its operation easier, and the appearance of the fixture more attractive as a whole.

NEW BOOKS AND PUBLICATIONS.

APPLETON'S AMERICAN CYCLOPEDIA, VOL. XIII, "Palestine" to "Painting." In Sixteen Volumes, \$5 each. New York city: D. Appleton & Co., Broadway.

The thirteenth volume of the revised edition of this work has lately been issued. It opens with an excellent colored map of the Holy Land, which accompanies an article in which due reference is made to the latest explorations and archaeological discoveries in that interesting portion of the globe. The article on "Plants" is very full, and is copiously illustrated with excellent engravings and a chart showing the distribution of plant life over the world. Among other notable articles are those on "Paper," "Paris," "St. Paul," "Patagonia," "Persia" (with map), "Phonography" (an excellent exposition of the science), "Phosphorus," "Political Economy" (by that eminent writer, Henry Carey Baird, of Philadelphia), and "Patent Law," the last article being by Hon. E. T. Drane. The volume is fully up to the high standard of its predecessors.

Inventions Patented in England by Americans.

(Compiled from the Commissioners of Patents' Journal.)

From October 19 to October 23, 1875, inclusive.

AIR COMPRESSING ENGINE, ETC.—E. Cope et al., Hamilton, O.
ARTIFICIAL FUEL.—T. H. N. McPherson, Washington, D. C.
ATTACHING BUTTONS, ETC.—D. Heaton, Providence, R. I.
BALE TIE.—T. H. Murphy, New Orleans, La.
BUCKLE.—W. T. Reaser, Centralia, Wis.
CUTTING OUT TABLE.—J. Herts, New York city.
DIAMOND HOLDER.—J. W. Branch, St. Louis, Mo.
GRINDING MACHINERY, ETC.—J. W. Blake, Jersey City, N. J.
LEAD TRAP.—F. N. Du Bois, New York city.
PRINTING INKING APPARATUS.—A. Campbell, Brooklyn, N. Y.
RAISING AND DELIVERING GRAIN, ETC.—W. H. Brown, New York city.
REFRIGERATOR, ETC.—L. C. Cattell, Cleveland, Ohio.
WATER MEYER.—D. W. C. Taylor et al., Brooklyn, N. Y.

Business and Personal.

The Charge for Insertion under this head is One Dollar a Line. If the Notices exceed Four Lines, One Dollar and a Half per Line will be charged.

Shoe-Peg Machinery, as follows: Sawing and Heading Machine, with 36 in. taper-ground saw. Price \$135. Baldwin Pointer, 3 rolls, good as new. Price \$137. Baldwin Splitter, with ratchet-feed. Price \$40. Boring Lathe, for cutting out knots. Price \$25. Bleaching Furnace and Fan, 18 in. Price \$35. New Steam Dryer and fixtures, containing over 600 feet $\frac{1}{2}$ in. pipe, copper-covered, and made in the most thorough manner, 35-bushel size. Price \$375. Screens, good order. Price \$37. Or, if all the above are wanted by one person, will put in the seven machines for \$140 cash. If desired, will sell the hangers, pulleys, and shafting used to drive same, at 60c. per lb. There are two lines shafting, one $2\frac{1}{2}$ in. diameter, 46 feet long, and one $1\frac{1}{2}$ in. diameter, 25 feet long. This machinery is all in good order, ready to start up, and will turn out 20 to 30 bushels per day, and with a few slight additions, costing but little, the capacity could be doubled. For further particulars, address S. C. Forsyth & Co., Manchester, N. H.

A Bargain—Jackson (Mich.) Ag'l Wks for Sale.

Wanted—The best Power Matching Machine in the market. Send circulars and capacity of machines to Melendy Bro's, Nashua, N. H.

22 years old—Inventive mind wants to work in machine shop. A. G. C., Lock Box 54, Lawrence, Kan.

Cutter's Pocket Inhaler, patented through the Scientific American Agency, has had a more extensive sale, in a given time, than any medical instrument ever invented. Read advertisement in this paper, and send for a circular.

Lumbermen say, after using R. Hoe & Co.'s Chisel tooth saws many months, that they would not accept a solid tooth saw, with files and tools to keep it in order, if given free. They will run no other saw.

Wanted—A business man with \$10 to \$50,000, to manufacture the best gothic chairs, secured by patent. Manufacture and machinery now in operation; or I will sell part or all of the patent. F. W. Krause, 72 West Washington St., Chicago, Ill.

1 Horse Engines \$50, 2 horse \$100, without boilers, at T. B. Jeffery's, 233 Canal St., Chicago, Ill.

The American Standard of Bolts and Nuts (Chart) Price \$1. Address E. Lyman, C.E., New Haven, Conn.

The London Mfg Co., 24 Grand St. N.Y., are making a very superior Varnish. In fact, it is considered the best in the market. Give them a trial and you will be satisfied.

"Amongst the live and progressive institutions of the day is Geo. P. Rowell & Co's Advertising Agency, No. 41 Park Row, New York. The establishment is so systematized, and their facilities are so ample, that the public is sure of being served in the most complete manner."—[Boston Post.]

25 per cent saving in fuel or extra power guaranteed to steam engines by applying the R. S. Condenser. T. Sault, Consulting Eng'r, Gen. Agt., New Haven, Ct.

Wanted—A first class Pattern Maker. H. B. Smith, Smithville, Burl. Co., N. J.

Single, Double, and Triple Tenoning Machines of superior construction. Martin Beck, Lebanon, N. H. Patent for Sale—An Acrobat performing all kinds of motions on a barrel or ball. A new Toy. F. C. Leypoldt, 243 North 5th St., Philadelphia, Pa.

Wanted—A Sorby-Browning Micro-Spectroscope, new or 3d hand. H. A. Sprague, Charlotte, Me., U.S.A.

To Iron Manufacturers—Wanted Iron Saw Blades for sawing marble. Send price. Boyd & Chase, Harlem N. Y.

We call attention of Amateur Workers in Fancy Woods to the advertisement of Messrs. Geo. W. Read & Co., on page 349, who have always a good supply of Fancy Woods on hand.

A First Class and Energetic Machinist wants to go into business of any kind. Any one knowing of an opportunity, please address Machinist, P.O. Box No. 523, Susquehanna Depot, Pa.

Dies and Punches—R. Woodman mfrs the Best. 36 Sudbury St., Boston, Mass. Manufacturers of Fancy Sheet Metal Work.

Lathe Wanted—Foot motion, screw-cutting, finely fitted. Address Screw Lathe, Herald Office, New York.

Gothic Furnace, for coal and wood, heats houses & churches. Send for book. A.M. Lesley 226 W 23d St., N.Y.

Traction Engines, good order, for Sale cheap—International Chemical Works, 30th St., Hunter's Point, N.Y.

Double-Entry Book-Keeping Simplified. The most successful Book on the subject ever published. Cloth, 11. Boards, 75 cts. Sent post paid. Catalogue free. D. B. Waggener & Co., 424 Walnut St., Philadelphia, Pa.

Bolt Headers, both power and foot, and Power Hammers, a specialty. S. C. Forsyth & Co., Manchester, N. H.

Main Driving Belts—Pat'd Improvement. Address for circular, Alexander Bro's, 412 N. 3d, Philadelphia, Pa.

Electric Burglar Alarms and Private House Annunciators; Call, Servants' & Stable Bells; Cheap Telegraphs; Batteries of all kinds. G. W. Stockley, Cleveland, O.

For Sale, cheap—One 60 H.P. Boiler, 40 Engines and Boilers. Address Junius Harris, Titusville, Pa.

Steam and Water Gauge and Gauge Cocks Combined, requiring only two holes in the boiler, used by all boiler makers who have seen it, \$15. Hillard & Holland, 31 Gold St., New York.

Hand Fire Engines, Lift and Force Pumps for fire and all other purposes. Address Rumsey & Co., Seneca Falls, N. Y., U. S. A.

Hotchkiss Air Spring Forge Hammer, best in the market. Prices low. D. Frialde & Co., New Haven, Ct.

"Pantect," or Universal Worker—Best combination of Lathe, Drill, Circular, and Scroll Saw. E. O. Chase, 7 Ailing Street, Newark, N. J.

To Manufacturers—Pure Lubricating Oil, Sample Package (24 gals.), \$7. Send to Geo. Allen, Franklin, Pa.

Educational Lantern Slides—Send for Catalogue or free. W. A. Anthony, Cornell University, Ithaca, N. Y.

Hotchkiss & Ball, Meriden, Conn., Foundrymen and workers of sheet metal. Fine Gray Iron Castings to order. Job work solicited.

For Sale—Second Hand Wood Working Machinery. D. J. Lattimore, 31st & Chestnut Sts., Phila., Pa.

Price only \$3.50.—The Tom Thumb Electric Telegraph. A compact working Telegraph Apparatus, for sending messages, making magnets, the electric light, giving alarms, and various other purposes. Can be put in operation by any lad. Includes battery, key, and wires. Neatly packed and sent to all parts of the world on receipt of price. F. C. Beach & Co., 246 Canal St., New York.

Peck's Patent Drop Press. Still the best in use. Address also Peck, New Haven, Conn.

All Fruit-can Tools, Ferracute Wks, Bridgeton, N. J.

Brass Gear Wheels, for Models, &c., on hand and made to order, by D. Gilbert & Son, 312 Chester St., Philadelphia, Pa. (List free.) Light manufacturing solicited.

American Metaline Co., 61 Warren St., N.Y. City. Genuine Concord Axes—Brown, Fisherville, N.H.

For Solid Emery Wheels and Machinery, send to the Union Stone Co., Boston, Mass., for circular.

Faught's Patent Round Braided Belting—The best thing out—Manufactured only by C. W. Army, 148 North 3d St., Philadelphia, Pa. Send for Circular.

Diamond Tools—J. Dickinson, 64 Nassau St., N.Y.

Magic Lanterns and Stereopticons of all sizes and prices. Views illustrating every subject for Parlor Amusement and Public Exhibitions. Pays well on small investments. 72 Page Catalogue free. McAllister 49 Nassau St., New York.

Temples and Oilcans. Draper, Hopedale, Mass.

Water, Gas, and Steam Goods—New Catalogue packed with first order of goods, or mailed on receipt of eight stamps. Bailey, Farrell & Co., Pittsburgh, Pa.

The "Scientific American" Office, New York, is fitted with the Miniature Electric Telegraph. By touching little buttons on the desks of the managers, signals are sent to persons in the various departments of the establishment. Cheap and effective. Splendid for shops, offices, dwellings. Works for any distance. Price \$6, with good battery. F. C. Beach & Co., 246 Canal St., New York, Makers. Send for free illustrated Catalogue.

For best Bolt Cutter, at greatly reduced prices, address H. B. Brown & Co., New Haven, Conn.

The Baxter Engine—A 48 Page Pamphlet, containing detail drawings of all parts and full particulars, now ready, and will be mailed gratis. W. D. Russell, 18 Park Place, New York.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing Metals. E. Lyon, 470 Grand Street, New York.

Spinning Rings of a Superior Quality—Whitinsville Spinning Ring Co., Whitinsville, Mass.

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

Solid Emery Vulcanite Wheels—The Original Solid Emery Wheel—other kinds imitations and inferior. Caution—Our name is stamped in full on 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.

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

Notes & Queries

O. C. W. will find directions for utilizing old tin cans on p. 319, vol. 31.—G. A. B. and W. M. will find directions for bluing steel on p. 123, vol. 31.—S. M. T. can transfer engravings to glass by the process described on p. 123, vol. 30.—W. F. McL. will find a good recipe for making black ink on p. 203, vol. 29.—L. L. L. will find directions for soldering iron and brass on p. 251, vol. 28.—F. S. can exterminate moths from carpets by the process described on p. 388, vol. 29.—J. S. will find directions for making gun cotton on p. 282, vol. 31. Celluloid is described on p. 23, vol. 33.—T. M. W. will find directions for silvering mirrors on pp. 257, 331, vol. 31.—S. C. can mount chromos, etc., by following the directions on p. 91, vol. 32.—A. S. can waterproof his leather boots by using the recipe given on p. 155, vol. 28.—B. A. C. will find a recipe for a depilatory on p. 362, vol. 32.—G. will find a good recipe for stove polish on p. 219, vol. 31.

(1) A. McC. asks: What is the best speed for the bucket of an overshot water wheel? Our wheel runs at the rate of 10 feet per second. Some millwrights claim that if we reduce the speed one half we will get double the power out of the same water. Are they right? A. We could not answer positively without more data; but in general, the speed of the periphery of an overshot wheel is not more than 5 or 6 feet per second.

(2) T. J. C. asks: What is the best way of joining logs together, to form a boom? A. For ordinary cases, chains answer very well, if the logs are kept in position by piles, driven in pairs, at intervals.

(3) S. C. B. says: I intend using a permanent tread power. Is there any disadvantage in placing it on a level, requiring the horse to work in harness instead of on an incline? My own views are that the horse will work more easily on the level, which distributes the labor upon his legs nearly equally, whereas the other plan overtaxes the hind ones. A. Probably the matter can only be settled definitely by experiment. Some inclination is generally considered advisable, so as to allow part of the weight of the animal to act against the resistance. We imagine some of our readers can furnish useful hints on this subject; and if so, we would be glad to hear from them. The tread power is not ordinarily as efficient as the lever power, in which the horse walks in a circle of large diameter; and for a permanent power, it is better to call in the aid of steam.

(4) H. H. A. asks: What kind of oil should be used as a base to mix with powdered slate to paint a roof with? A. Linseed oil is the best to use, and the expense for one roof would not be very great.

(5) H. C. E. says: 1. I have a boat, 21 feet long by 7 feet 6 inches beam, drawing 12 or 15 inches of water. I built an engine 3x5 inches, with a link motion. Is the engine large enough for the boat? A. Yes. 2. I have a $\frac{1}{2}$ inch feed pipe and $\frac{3}{4}$ inch exhaust. Is the exhaust too small for the engine? A. It will answer very well. 3. What size of propeller should I use? A. Of 18 or 20 inches diameter, $2\frac{1}{2}$ feet pitch. 4. What size of boiler is required? A. About $2\frac{1}{2}$ feet diameter, 4 feet high. 5. What is meant by the pitch of a propeller? A. It is the distance it would move the boat, at each revolution, if it worked in an unyielding medium, like a screw in a nut.

(6) C. A. A. asks: Is it any benefit to a rubber band to oil it? A. Quite the contrary.

What is the best way to treat posts to make them last? A. It is recommended to dip them into tar.

Are small vertical engines, with cast iron flues, as safe as those with wrought iron tubes? A. We do not understand what you mean by the flues of an engine; but if you refer to the boiler, the wrought iron tubes are preferable.

(7) E. F. asks: Is there anyway of setting glass in skylights? A. To make a good skylight, use iron bars and adopt a steep pitch; 45° is none too steep. Purchase your putty or cement of the patent vault light manufacturers of this city. If you wish to repair a skylight, use the same kind of cement but you cannot depend upon wooden bars.

(8) S. H. D. asks: How can I take a copper counter die from a brass die? A. Take a plaster of Paris cast from the die, and use it as a mold, melting two per cent of spelter with the copper to flux it.

(9) A. L. C. asks: What percentage of sea water is salt? A. Ordinary sea water contains about 3 per cent, by weight, of salt.

It is said that Pythagoras knew how to predict an eclipse by means of the saros. What is a saros? A. It was an ancient astronomical period, the length of which is a subject of debate.

I want to build a model ship 6 feet long. Can you give me some rules that will assist me in shaping the hull? A. Get a drawing of the lines of some well designed ship, and work from that.

(10) J. M. H. asks: By what process can finely ground flint glass be incorporated with Babbitt or other metal for lining boxes, for heavy machinery running at high speed? The object is to prevent the heating and rapid wear of the journals. A. We know of no process, and we think that the mixture would cause the bearings to abrade.

(11) G. E. P. says: Some time ago you discussed the proposition that the top of a wheel of a wagon in motion moved faster than the bottom. Is there any formula for computing how much faster the top moved than the bottom, or than the hub? A. At the highest point the velocity is twice as great as at the center, and at the lowest point the velocity is zero.

(12) A. H. asks: In making bell metal (about 77 copper to 23 tin) I have been in the habit of employing a flux composed almost entirely of lime. Over 5 per cent of the metal is burnt up; and the slag will sometimes be an inch thick in the bottom of the reverberatory furnace. Is there a flux which will effectually separate the metal from all impurities? A. Use a little borax or sal ammoniac.

(13) C. A. B. asks: What will remove, from the walls of a brick building, the oozings or collection of salt-peter? A. It is probably not salt-peter, for if it were the rain would remove it, it being very soluble in water. If it is an insoluble salt of lime, try a little dilute muriatic acid, and then wash well with water.

(14) G. F. says: 1. I have a six horse horizontal engine; it makes a slight thump which I am unable to locate. The center of the driving shaft is $\frac{1}{4}$ inch higher than the center of the cylinder; would that cause a thump? A. The shaft being out of line is most probably the cause of the thump. 2. I am running a line shaft at 120 per minute, and an engine at 75. Could I economize by putting a larger pulley on shaft and running the engine at 100 per minute, using same pressure? A. The proposed increase of revolutions will prove economical, providing the wearing surfaces and the proportions of the various parts are large enough to sustain it. The thump would, however, increase with the speed.

(15) R. R. Z. asks: What will dissolve hair and wool mixed with small pieces of bone? I wish to retain the ammonia. I want to use it in a drill as a fertilizer. A. Ammonia can be obtained from bones, etc., only by a process of destructive distillation. It does not exist, in any quantity, in the bones themselves, but is formed when they are decomposed, in airtight vessels, by a high temperature.

(16) W. H. M. and M. L. L. say: We want to bore a well in low land, where salt water flows and penetrates in the earth to the depth of 15 feet. Will galvanized tubing prevent the salt water from mingling with the fresh without the joints being screwed or soldered together? A. If you strike a spring of fresh water, the tubing you speak of will answer very well.

(17) S. G. asks: How can I extract the oil from kip pieces without injury to the leather, which is to be used for heels for shoes? A. Try bisulphide of carbon.

(18) A. says: The supply pipe from the boilers to a horizontal engine is 75 feet long and 14 inches diameter. It connects to the steam chest by an 8 inch pipe, 15 feet long. The cylinder is 40 inches in diameter, and of 46 inches stroke; it has a waste pipe from each head, that runs along to a flywheel pit, and then, by a quarter turn, down 15 feet into 2 feet of water. The engine worked water while working a heavy train of rolls. Parties here say she drew the water from the flywheel pit through the waste pipe. I say not, as there was 60 lbs. steam pressure to work against. Which is right? A. You are right, according to the account; the other parties may be right if the engine was a condensing one.

(19) B. F. G. asks: Is there anything that will dissolve shellac besides alcohol? A. Shellac dissolves in a hot solution of borax in water.

(20) W. C. asks: 1. What is the stream line theory? Allusion was made to a new theory averring the non-resistance of water or any perfect fluid to bodies moving through it, by Professor Froude, in a lecture which you printed about three weeks ago. That singular theory was called the theory of stream lines; but it was only alluded to. Will you explain what it is? A. It may be

briefly expressed, in the Professor's own words, as follows: "A submerged body traveling at steady speed through a stationary ocean of perfect fluid will experience no resistance."

How deep in the water can a dredge operate? A. It might not be safe to fix a precise limit, as it is generally found that, when dredging ought to be done, machinery can be designed to do it.

(21) A. B. says: I heated equal parts of manganese peroxide and potassic chlorate in a test tube, which I drew to a point, but I could not produce an oxygen flame. What was the reason? A. Oxygen, by itself, is not inflammable. Try a piece of wood splint with a spark on the end; the oxygen will cause it to burn very brilliantly.

(22) T. C. asks: How can rosin be purified for violinists' use? A. Treat the powdered rosin with a mixture of 6 parts cold alcohol and 1 of ether; dissolve the residue in boiling alcohol, and evaporate this solution to dryness over a water bath. If the residue be now melted, it yields, on cooling, a colorless substance as clear as crystal.

(23) H. D. M. says: I assert that as high a rate of speed as 70 miles an hour had been made on an English railroad. A friend says that 45 or 50 is the highest speed ever made. Which is right? A. A speed of 70 miles an hour has frequently been made in England for short distances. Some of the trains are timed to run at nearly 60 miles an hour. Similar speeds are occasionally made in this country.

(24) M. S. J. asks: What liquids can I use to dissolve white chalk, so as not to destroy any of the properties of the chalk, but leave it in a liquid state? A. You cannot dissolve chalk and leave its properties unaffected. Rub up precipitated chalk with a little gum water.

(25) J. P. S. says: As I am about to build a burial vault, can you give me some information as to how the inside of the vault should be built, and whether it should be shelved or not? A. A burial vault is usually built into the side of a bank of earth, in such manner as to have the floor thereof one step or so above the ground in front. A medium size would be 12 by 18 feet on the exterior, with the narrow end for front. Make the interior height 10 $\frac{1}{2}$ feet and cover with a semi-circular arch. Construct the receptacles for coffins at the back end of the vault; these may be about 20 inches high, 28 inches wide, and 8 feet in depth. Make the bottoms or shelves of these receptacles of planed blue stone or slate slabs, $2\frac{3}{4}$ inches thick, placing the first slab upon the floor of the vault, showing its thickness above the floor; build the upright partition walls of brick in cement, and 4 inches thick. Make the slabs wide enough to serve for two compartments each, there being four in the width of the vault. This will give you four tiers of four receptacles each, and two in the upper curve of the crown, making eighteen in all. The front ends of the partitions should be faced with the blue stone or slate, into which facing cut a groove, and insert a closing slab of marble or other stone to close each opening. Pave the space in front of the cells as a vestibule with stone— which may be fine marble tiling, if so required. The entrance door may be closed with either an iron gate or marble slab, so inserted as to be easily taken out. The exterior may be faced with granite and the walls coped with the same; but the top needs only to be cemented so as to shed the water, covered with mold, and laid with grass sod.

(26) C. D. B. says: I have a compound composed of the following ingredients: Venice turpentine, sweet oil, lard, and beeswax. What cheap substance, that will not injure the skin, can I add to destroy the smell of the turpentine? A. You will have to counteract the objectionable odor by the addition of some agreeable perfume.

(27) E. D. S. asks: Is there any substance that will serve better than good sponge for filtering a $\frac{1}{2}$ inch stream of water? The chamber for filter will be 2x3x4 inches, and I wish to arrest merely the floating particles. A. Try a carbon filter.

(28) G. C. asks: Would the Cornish or double beat valve be suitable for an engine with 30 inch cylinder and 42 inch stroke, making 65 revolutions per minute with a pressure of 80 lbs.? The reason for wanting to adopt it is that the engine has frequently to be worked by hand, with full head of steam. A. If the Cornish valve can be applied, it will be suitable.

(29) A. T. B. says: We make steam in our boilers for the purpose of evaporating brine, using a pressure of 50 or 60 lbs. to the inch. Would the same fuel make more salt if no pressure were carried in the boilers? A. If there be no pressure in the boilers, the heat will not exceed 212°, and only hot water could be conveyed away from the boilers. If steam is to be circulated to any distance from a boiler, there must be a pressure to move the steam through the pipes.

(30) F. F. T. asks: Which would be the most economical as regards fuel, to run an engine at 110 or at 160 revolutions per minute? A. Generally, the higher speed is the most economical.

(31) D. M. M. asks: How can I re-japan stands of sewing machines, without baking them? A. Take asphaltum 48 lbs., fuse, and add boiled oil 10 gallons, red lead and litharge each 7 lbs., dried and powdered white copperas 3 lbs.; boil for 2 hours, then add of dark gum amber, fused, 8 lbs., hot linseed oil 2 gallons. Boil till the mixture is pasty, then thin with oil of turpentine 30 gallons.

(32) E. H. says: I want to build a 20 horse power water wheel, and to have the buckets attached to some flexible material like those of a corn elevator. What would be the best material to fasten the buckets to? A. An endless chain. 2. How can I calculate the horse power obtained? A. In the absence of any given conditions, we cannot tell you how to calculate the power except from the duty obtained from the device when in practical operation.

(33) H. E. K. asks: How are buckskin gloves, etc., cleaned? A. Wash them in lukewarm soft water, with a little Castile soap, oxgall, or bran, then stretch them on wooden bands, rub them with pipe clay moistened with beer; let them dry gradually, rubbing them from time to time so that they do not lose their shape in drying.

(34) G. asks: What are the ingredients of blue or mercurial ointment? A. Take prepared lard 1 lb., mercury 1 lb., prepared suet 1 oz. Rub them together in a marble mortar till metallic globules cease to be visible.

(35) A. H. H. says: In your answer to G. L. B. you say "the recoil of a rifle is felt before the ball leaves the barrel," which means, I suppose, that the recoil comes before the ball passes out of the gun. Not being satisfied with this answer, I made a few experiments, and the results do not fully agree with you. I tried an experiment as represented in the engraving. The rifle I used



had telescope sights and a hair trigger, and weighed altogether 7½ lbs. Caliber was 0.4 inch; the ball was 1½ inches long, and 70 grains powder was used. On a very firm table, A, was secured a block, B, high enough to bring the barrel, D, parallel with the table. At C, I fastened a yoke 4 inches long at right angles with the barrel, D, to keep the gun from turning over on one side when it was discharged. The stock rested on the table at F; and back of this was placed an inclined plane or wedge, as shown at G. I fired three shots, and in Fig. 2 have marked them 1, 2, 3. I then removed the wedge and fired three more shots, marked 4, 5, 6. At every discharge the recoil was so great that the rifle left the table entirely. You will see that there is only ½ an inch difference in the location of the bullet. By moving the gun back on the wedge ¾ inch, the sights are on the lower shots; and when on the table they are on the upper ones. Distance was 60 feet.



Why is it, if the recoil takes place before the ball leaves the gun, that there was not more difference in the shooting? A. The explanation of these experiments is probably somewhat as follows: As soon as the explosion of the powder occurs, a pressure is exerted in the barrel tending to impel the ball forward, and the gun backwards. If there is anything, such as a human shoulder, at the end of the stock, the recoil is felt at once; and if the shock is considerable, it is apt to injure the accuracy of the aim. If, however, the gun is free to move backward, as in the experiments made by our correspondent, it will commence to move at the same time that the ball does, under the influence of the same pressure; but being many times heavier than the ball, the latter acquires the velocity due to the pressure in a much shorter interval, and is out of the barrel when the gun, under the action of the same force, has just moved a little.

(36) S. S. asks: Please give me a recipe for crystallizing alum on a wire basket. A. Dissolve as much powdered alum in hot water as the water will hold; then suspend your wire basket in by a thread, and let it cool.

(37) W. H. asks: Does water, placed in a cup on the top of a stove, have any effect in purifying the air? A. No; but it prevents the excessive dryness of the air, which is very injurious to health.

(38) J. F. says: I have a gutta serena pocket drinking cup, and I broke one of the rings; can you tell me if there is any way to mend it? Glue would not hold it. A. Melt together equal parts of gutta serena and pitch. Apply hot.

(39) P. H. asks: Is there any method by which scale can be prevented from forming on the inside of a tubular boiler? A. The means of prevention vary with the qualities of the water. Unless the nature of the impurity be known, no specific can be recommended.

(40) D. T. S. says: I have noticed that in this section the willow trees all lean to the north. Can you tell me why? A. We think it is simply indicative of the average direction of the wind. Young willows grow quite rapidly, and their yielding nature makes them very sensitive to the slightest breeze.

(41) I. H. B. asks: How can I fire a charge with a battery? A. Solder a short piece of very thin platinum wire to copper wires leading from the battery to the place where the discharge is to be effected; place the platinum wire in powder or other explosive substance, and, when the proper moment arrives, include the battery in circuit. It is doubtful if one cell will be sufficient, certainly not unless the resistance of the circuit, including that of the battery, is very low. A large bichromate cell without porous cup would answer better than a Grove.

(42) F. M. asks: Can air be heated by electricity? A. Yes.

(43) G. F. B. says: The last two batteries I have made have not been successful. I use zinc and carbon plates. My solution consisted of sulphate of mercury 1 part, bichromate of potash 2 parts, sulphuric acid 4 parts, water 15 parts. When I first put the solution in the batteries, I got a very strong current of electricity; but after 15 or 20 minutes' use, it got very weak, and, after using a few times, the batteries would not work at all. The liquid turned to a greenish color, and there was a black sediment at the bottom of the jar. What is the matter? A. Single fluid bichromate

cells cannot be depended upon to furnish a steady current for any length of time. Their constancy, however, may be somewhat increased by causing air to bubble through the solution. Renew the solution, and brighten the connections.

(44) J. W. asks: 1. What is in the porous cup of a Léclanché battery? A. Peroxide of manganese. 2. If the magnet of a relay become partially magnetized, is there any way of drawing the magnetism out? A. Careful annealing is the only permanent way.

(45) J. C. L. asks: What is salt of steel? A. Probably muriate of steel, used in medicine, is intended by this term.

(46) G. W. F. says: I am building a small magnetic battery, and do not know how to arrange the wire to derive the currents from it. Can you help me? A. Make an ivory or hard rubber ring to go on the shaft, to this ring fit another of brass, and fasten the two together with screws; after which saw through the brass ring on opposite sides and in the direction of its length. The outer ends of the coils are then to be soldered to the semi-cylindrical pieces of brass, and two stiff springs, to which wires are attached for terminals, are made to press against the latter.

(47) O. P. asks: 1. Is there any metal that can be permanently magnetized? A. Yes, tempered steel. 2. How is it done? A. By enclosing it in a helix in which a powerful electric current is circulating, or by rubbing it several times from its middle point to the ends with a permanent or an electro-magnet. Care must be taken to use opposite ends of the charging magnet for the different halves of the magnets to be charged.

(48) E. G. A. asks: Are there any cases on record where lightning passed down a lightning rod, when the rod, being tested, was found to be in good order, or (in other words) its resistance was small? A. We do not recall any at this moment; but as more or less electricity continually traverses all rods, cases might be found. Sometimes a very heavy charge destroys the efficiency of the rod; the defects, however, are usually apparent in such cases.

(49) J. A. R. asks: What is the reason that in electro-silverplating the silver blisters on the work and comes off in spots? A. All deposits are apt to blister and come off when the objects are not properly cleaned. 2. Where can a work on electro-silverplating and gilding be bought? A. Works on electro-deposition are obtainable at almost any of the large bookstores. Sprague's "Electricity: Its Theory, Sources, and Application" can be recommended.

(50) C. J. M. asks: 1. Can you give a recipe for varnishing the coils (outside) of an electro-magnet? A. Shellac is good, and is often used for the purpose. 2. In laying wires under carpets or other dry places, must the wires be insulated? A. It will answer to use uninsulated wires if the ordinary battery current is employed. Such wires are, however, apt to cause much annoyance by getting together and thus interrupting the circuit.

(51) J. W. E. asks: Is there any remedy for dreaming? A. When the digestive organs are in good order, and there are no external noises or other circumstances to excite dreams, sleep is seldom disturbed in this way; but any troubles in the alimentary canal are usually accompanied by painful dreams, more or less intense. Keep your body in health, and your rest will probably be uninterrupted.

(52) F. J. asks: What ingredients can we put into flour paste, for uniting two or more thicknesses of paper, and to stand the effect of steam? A. We do not know.

(53) K. asks: Suppose that a gas, condensed by pressure to a liquid form, is cooled by a refrigerating mixture to a considerably lower point than another quantity of gas likewise condensed, but which is at the ordinary temperature of the surrounding atmosphere. Will the first or cooled gas in expansion possess an appreciably greater capacity for absorbing caloric than the non-refrigerated gas? A. The gas which had undergone the greatest refrigeration would, upon the expansion to its original volume, absorb the greatest amount of heat, other things being equal.

(54) F. M. asks: What roots are used in medical practice, which have the property of giving a jet black color? A. Extract of logwood, walnut peels and shells, coppers and nutgalls are employed for staining black. We know of no single root that will give a satisfactory black stain.

(55) K. says: I saw in a recent issue of your valuable paper an answer to a correspondent who wished to obtain a colorless solution of salt of copper. If he will take strong aqua ammonia, and place it with copper chips in a bottle, in a short time he will have a salt of copper in solution which, while exposed to the action of air, will be of a fine blue color, but, upon corking the bottle airtight, in a few hours will become colorless, until again exposed to the air, and so on. A. Our observations with regard to the ammonio-cupric oxide do not sustain yours.

(56) W. K. asks: Can lightning gas be made from nightsoil and dead animals, the gas being used, and the residue employed for fertilization? A. We think the gas would not be rich enough in hydrocarbons to be employed, and the residue would probably be badly carbonized.

(57) J. O. M. asks: Why are bricks made in Philadelphia so much richer in color than those made in Albany? A. It is due to the large proportion of red oxide contained in the material.

1. How is red oxide of lead made? A. It is obtained by roasting litharge at a temperature of about 500°, in contact with the air. 2. How is red oxide of iron made? A. The coarse pigment is obtained by pulverizing and igniting the red or brown hematite. The finer grades are prepared by precipitation of a solution of ferric sulphate or chloride with excess of ammonia, and washing, drying, and igniting the yellowish-brown hydrate thus produced.

(58) S. S. S. asks: What is the most durable paint to put on a steam pipe? A. There is a black varnish, made from petroleum, which answers as well as anything of which we have knowledge. We have received so many inquiries on this subject that we think it would be well for manufacturers of this varnish to advertise in our columns.

(59) S. H. B. says: 1. I want to make a steam engine boiler, to be 3 inches by 4 inches and 6 inches long. Would copper nearly as thick as cardboard do for the boiler? A. Yes. 2. Would a mixture of zinc and pewter do for the cylinder? A. Yes. 3. Is there any danger of a boiler bursting that is made of such copper? A. You should put in a safety valve. 4. Please explain how the steam gets from steam chest to cylinder. A. Through an opening or port, over which the valve moves. 5. How large must I make the different parts of the engine? A. Get a good drawing of an engine, and proportion the parts from that.

(60) F. D. says: 1. I have invented a tool for breaking slag in furnaces, and wish to know where it can be put to a very severe test. A. Take it to an iron foundry. 2. Is there much clinker formed in the furnace of steamers, and how is it removed? A. With some kinds of coal a great amount of clinker is formed. It is generally removed with a sledge bar.

(61) P. L. V. H. says: My son, aged 19, is desirous of becoming a skillful engineer in the merchant marine; he has worked at the machine business some two years, is well up in mathematics, understands the theory of the steam engine, both marine and land, and can furnish testimonials as to character and ability. What course should he take to become fitted for the position of chief engineer on one of our large ocean steamships? A. His best plan will be to enter the merchant service in as good a position as he can obtain, and work his way up.

(62) R. K. asks: Is there a machine for carrying sand from a river bank to a boat at a distance from the shore? A. There is a sand pump in the market, working on the principle of the steam siphon. Such pumps were used in making the excavations for the Brooklyn bridge.

(63) W. Y. says: A friend says that when an engine is on the center the live steam port should be open. I say it should be shut. Who is right? A. Ordinarily it is advisable to have the steam port slightly open when an engine is on the center. This is called giving the valve steam lead. 2. He says that the right name for the crank pin is the wrist. I say the crank pin is correct. Who is right? A. Both terms are correct, that is to say they are both sanctioned by general usage. The term wrist pin, however, is more general in its application than crank pin.

(64) E. N. says: I have run a stationary engine for 13 years, but have no certificate. What should I have to pass an examination in to obtain one? A. It will depend upon the local laws of your State. Apply to an inspector.

(65) R. W. asks: 1. What is the proper area of steam passages for small engines up to 6 inches diameter? A. Make the area of your ports one eighth that of the cylinder. 2. When the diameter of cylinder, stroke of piston, and pressure are given, by what rule do you determine the number of revolutions which an engine ought to make? A. Calculate this from the duty to be performed. See p. 33, vol. 33.

(66) H. J. E. asks: I. How should wax be prepared for waxing stove patterns, and how should it be applied? A. Get the best beeswax; then slightly heat the castings, and rub them over with the wax, wiping off the surplus wax with a piece of soft rag.

(67) T. P. says: 1. I have to use a round cast iron sleeve, 9 inches long and 2½ inches in diameter, with a square 1¼ inch hole through the center of the same. The foundry where I now get my castings uses common sand or clay cores, which leave the corners of the holes rough. The holes must be smooth and straight. Baked cores are liable to warp. Is there not some better plan? A. Have the sand cores faced with plumbago. 2. Could an iron bar be prepared and used as a core, and yet come out of the casting when cold? A. An iron bar cannot be used.

1. How can I polish steel by hand? A. After fine filing, use emery cloth, then crocus, and finally rouge or polishing powder. 2. Is there any liquid used after polishing? A. No.

(68) B. F. S. asks: How shall I fill and polish church pews of ash, trimmed with walnut? A. The best way is to French polish them. See p. 11, vol. 32.

(69) P. D. says: In "Practical Mechanism," Joshua Rose says, of the boring bar with the adjustable cutter head, that it will bore a round hole, even though the bar may run out of true by reason of either or both of the centers being misplaced, or even though the bar itself may have become bent in its length. I should infer from this that he means to say that any other form of a boring bar would bore an oval or other irregular hole in similar circumstances. I claim that no form of boring bar will bore an unround hole by reason of being bent in its length or running out of true. The cutter that is farthest from the center will do all the cutting, but at the same time it will describe a true circle. A. A boring bar with a fixed

head will bore a round hole whether the bar runs out of true or not, providing the carriage carrying the work travels in a line with the center line between the centers on which the bar revolves; but if the bar runs out of true with the shears (as in case the back center of the lathe is set to one side), the hole bored will be oval, although the cutters revolve in a circle.

(70) C. F. asks: How can I extract the gold from emery paper which has been used to polish gold? A. If the paper be treated with a little mercury, the latter will remove all the gold, with which it forms an amalgam. If this amalgam be subjected to a strong heat in a small iron retort (the beak of which or its connection should dip beneath the surface of some cold water), the mercury will be vaporized, and, distilling over, be condensed in the water, leaving the gold behind in the retort. Avoid inhaling the mercurial vapor. It is very pernicious.

(71) F. H. F. asks: Please give me a rule for laying out eccentric gearing. A. Find the center of the hole in the eccentric, and then set the compasses to within half an inch of the extreme circumference of the eccentric part, and mark a line clear across; then find the center of that line, and draw a line from it to the center of the shaft hole, which line will be the throw line, on which a center should be marked at a distance of half the required amount of valve travel, measuring from the center of the eccentric hole; and from these centers mark circles of the required diameters to suit the shaft and the strap. All the marking should be done on the plain and not on the hub side of the eccentric.

(72) D. S. C. asks: How can I mix aniline red to put on leather, so that it will not turn dark when it is varnished with shellac? A. The darkening of color is probably due more to the substances used in tanning the leather than to the varnish. The common solvent is a mixture of equal parts alcohol and water.

(73) F. L. H. says: There is a gentleman at this place who uses old kerosene barrels to put cider in. He claims that a little cider will cleanse the vessel thoroughly, after which it can be used for packing pork and other things, without causing them any injury. The cider seems to have an action on the oil, if added to a portion in a bottle. Please tell me the chemical action by which this result is obtained. A. If this method is successful, it probably depends upon the slight solubility of the oil in the small percentage of alcohol contained in the cider.

(74) A. K. says, in reply to G. A. F.: It is very likely that calamine has been found in Oregon, as carbonate of zinc occurs very frequently in that Territory. But only a wet analysis will determine it.

(75) J. G. says, in answer to C. A.'s query as to the force of gravity deviating the ball from its direction of projection: This is always so, except when that direction is vertical. In firing at any object out of a vertical line, a certain amount of elevation must be given to make up for the distance through which the ball will fall (on account of its weight) between the instants of leaving the barrel and striking the object.

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

B. C.—It is Prussian blue.—T. L.—It is red hematite, a good iron ore, but it contains considerable siliceous matter.—W. P. C.—The name of the plant is *Oxalis tuberosa*, a genus in the natural order *leguminosae*. Its common name is ground nut or wild bean. The tubers are edible, but their value as food has not been determined. The brown-purple flowers are fragrant, and the plant is quite common in moist thickets in New Jersey.—L. B. D.—It is a fine crystal of sulphuret of lead or galena.—H. W. C.—It is lead ore of good quality.

J. P. O'C. says: I am tending a steam hammer, the weight being 4,000 lbs., including drop and piston. The inside diameter of the cylinder is 18 inches, and the hammer has a drop of 3½ feet. How many lbs. will it strike without steam on top, and how many lbs. will it strike with 90 lbs. of steam to the inch?—C. E. B. says: A roller weighing 112 lbs. is supported on an inclined plane, the gradient of which is 1 foot in 2, by a force which acts along its slope. What is the magnitude of this force, and what is the pressure on the plane, friction not being taken into account?

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 Interstellar Space. By —, and by T. H.
On Whistling. By H. B. N.
On the Washington Monument. By J. M.
On Skinning the Rhinoceros. By N. G. F.

Also inquiries and answers from the following: A. N.—R. E. McMe.—H. W.—C. J. J. R.—C. D. B.—J. G. B.—J. J. R.—W. A. H.—F. R.—T. M. C.—T. V.—W. M.—C. P. H.—J. O'B.—H. J. R.—P. & K.—D. M.—C. D. B.

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.

Enquiries 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 is the best foot power scroll saw? Who sells books on pottery, glass, etc.? Who is the best machine for making wood screws? Who sells steam engine indicators? Who is the best ice 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

October 26, 1875.

AND EACH HEARING THAT DATE.

(Those marked (r) are renewed patents.)

Alarm, electric, J. T. Bedford.....	169,077
Alarm and fastener, burglar, J. J. Woolsey.....	169,230
Alarm, burglar, C. and J. Bohannon.....	169,137
Alarm, burglar, J. A. Weed.....	169,214
Album, photograph, C. D. Mosher.....	169,186
Anchor tripper, E. Robbins.....	169,193
Annealing metals, J. H. Warrington.....	169,330
Antiseptic composition, H. Gahn.....	169,094
Auger, earth, J. Minick.....	169,115
Basket bottom, S. H. Wheeler.....	169,217
Bath, portable vapor, G. W. Brosius.....	169,142
Bedstead fastening, S. D. Futtler.....	169,233
Bedstead, invalid, A. J. Goodwin.....	169,099
Billiard table levelers, A. J. Michel.....	169,281
Binder, temporary, W. H. Bennett.....	169,136
Bird cage, D. F. Burns.....	169,145
Bit gage, A. B. Batson.....	169,075
Blind, inside, T. Fetherston.....	169,247
Blind slot operator, W. Strunk.....	169,127
Boiler incrustation compound, J. M. Wishart.....	169,219
Boiler, tubular, I. Barton.....	169,225
Bottle opener, etc., Klehl and Kohler.....	169,175
Box, wooden, Rosborg and Kawan.....	169,297
Brick machine, H. Sea.....	169,197
Buckle, harness, J. C. Smith.....	169,300
Building, metallic frame for, E. Gruwe.....	169,101
Bug and vent, H. B. Cornish.....	169,150
Burner, lamp, J. H. Fouch.....	169,161
Butter package, A. Robinson.....	169,292
Buttons, ornamenting, R. H. Isbell.....	169,268
Caddy, tea, R. Malner.....	169,118
Calcium light, N. H. Edgerton.....	169,244
Can, oil, Kuesner and Breuer.....	169,09
Can opener, R. Smith.....	169,202
Car axle lubricator, J. D. Stark.....	169,203
Car coupling, J. Harris.....	169,169
Car coupling, F. L. Small.....	169,204
Car coupling, J. B. Smith.....	169,201
Car wheel chime, W. Wilmington.....	169,325
Car window, railroad, A. Brandon.....	169,140
Cars, lighting railway, J. Story.....	169,136
Carburetor, H. J. Hyams.....	169,105
Carriage jack, Z. McDonald.....	169,273
Carriage painter's jack, G. A. Brice.....	169,082
Carriage seat, S. Gliringer.....	169,256
Carriage wheel, I. Kester.....	169,272
Castling door plates, m d fer, Dodge and Smith.....	169,154
Castings, making patterns for, W. E. Craig.....	169,151
Castings, making, W. Harnsworth.....	169,261
Cement, composition for, R. Warwick.....	169,212
Chair, rocking, A. Best.....	169,228
Chair, rocking, J. H. Travis.....	169,314
Cigar mold, H. Voltz.....	169,207
Cigar mouth piece, C. Reinfach.....	169,119
Cistern filter, etc., W. B. Wilson.....	169,130
Clasp for wearing apparel, E. Osgood.....	169,285
Cloth-winding machine, S. C. Dickinson.....	169,249
Compre s, hydraulic, E. D. Meier.....	169,280
Concrete articles, mold for, R. B. Lanum.....	169,178
Cooler, lard, J. G. C. Lee.....	169,180
Cooler, milk, W. R. Scofield.....	169,196
Corn marker, T. B. Kirkwood.....	169,177
Cornstalk cutter, S. Bean.....	169,134
Corset, J. W. Askie.....	169,131
Corset, S. B. Ferris.....	169,159
Cotton chopper, McMeekin and Hunt.....	169,183
Cotton, ginning, etc., J. L. Toole.....	169,206
Cradle, E. F. Gazzam.....	169,253
Cradle, J. Sprengard.....	169,123
Curtain fixture, H. L. De Zeng.....	169,090
Curtain fixture, W. H. Sparks.....	169,303
Cuspadores, etc., ornamenting, C. M. Lyon.....	169,278
Cutter bit, A. Streitt.....	169,204
Cutter head, S. P. Randolph (r).....	6,717
Door hanger, E. U. and W. L. Scoville (r).....	6,718
Door spring, D. H. Lewis.....	169,110
Double tree clip, W. Beckert.....	169,135
Doubling machine, T. Unsworth.....	169,215
Dovetailing machine, L. Atwood.....	169,132
Dredging bucket, C. J. Sands.....	169,299
Drill, ratchet, G. Hayden.....	169,262
Drill, rock, W. R. King (r).....	6,716
Drill, rock, Seddon and McPaul.....	169,121
Drying apparatus, J. S. Rogers.....	169,194
Eggs, desiccating, W. O. Stoddard.....	169,311
Elevator, water, J. H. Van Dyck.....	169,316
Embossing machine, S. Rogerson.....	169,29
Engine governor, marine, Briggs and De Pen.....	169,141
Engine, rotary steam, J. C. Johnson.....	169,269
Engine, steam, S. B. Frank.....	169,249
Faucet, W. C. North.....	169,284
Feather duster, J. L. Little.....	169,376
Feed cutter, B. J. Wylie.....	169,221
Fire arm, magazine, A. Burgess.....	169,082
Fire arm handle, A. Trenkmann.....	169,311
Fire dog, D. S. Hale.....	169,166
Fire escapes, folding stair for, T. Garrick.....	169,096
Fishing rod, H. L. Leonard.....	169,118
Fluting machine, C. Schneider.....	169,304
Furnace grate, H. W. Granger.....	169,250
Gaiters, button, A. Kenny.....	169,271
Game apparatus, revolving, J. W. Cameron.....	169,085
Game counter, Fey and Felix.....	169,100
Garter, Blakesley and Wright.....	169,221
Gas apparatus, H. H. Ramsey.....	169,299
Gas, illuminating, J. W. Beasley.....	169,326
Glass, manufacture of, J. H. Hobbs.....	169,102
Grain binders, J. Garrard.....	169,251
Grain binder, J. F. Gordon.....	169,258
Grain drill feed, E. Morgan.....	169,293
Harness mountings, covering, J. Feder.....	169,153
Harrow teeth, H. M. Williams.....	169,324
Harvester, J. M. Whittam.....	169,098

Harvester, C. W. Levalley.....	169,275
Heater and boiler, T. H. Harrington.....	169,167
Heater, feed water, Andrus & Wallace.....	169,074
Heating apparatus, smoke stack, T. B. Field.....	169,093
Heel-trimming machine, L. G. Clock.....	169,149
Hook and eye, J. C. Howells.....	169,267
Hook, snap, C. B. Bristol.....	169,234
Horse power, W. I. Grant.....	169,164
Horseshoes, ice nail for, H. M. Patterson.....	169,286
Hose, preparing animal, E. Bauer.....	169,076
Hydrant, Pease & Campbell.....	169,288
Indicator, revolution, C. H. Phinney.....	169,117
Inkstand, S. Darling.....	169,152
Ironing apparatus, R. H. Gardner.....	169,250
Jack for pressing, etc., M. J. Walsh.....	169,319
Journal box, P. Burns.....	169,343
Key hole guard, La Blanc et al.....	169,178
Klin, drying, D. Bonnell.....	169,230
Ladder, Case & Read.....	169,236
Lamp, G. W. Vernon.....	169,318
Lamp extinguisher, J. G. Hehr.....	169,263
Lamp-lighting apparatus, H. Iden.....	169,173
Lamp trimmer, H. L. De Zeng.....	169,091
Lock, seal, A. T. Boon.....	169,231
Loom, hand, J. E. Gillespie.....	169,098
Loom stop motion, Kent & Moore.....	169,108
Loom, swivel shuttle, J. Fish.....	169,248
Lounge, folding, N. H. Borgfeldt.....	169,138
Lubricator, W. P. Stephenson.....	169,124
Marble, artificial, W. C. A. Roettger.....	169,294
Marking wheel, H. Holt (r).....	6,714
Mashing and cooling, G. E. Ellenberger.....	169,156
Match safe, E. H. Whitney.....	169,129
Match sticks, cutting, J. S. Fagley.....	169,246
Millstone spindle trammel, A. Ebelman.....	169,157
Mop and brush holder, A. P. Seymour (r).....	6,719
Mowing machine, D. H. Gage.....	169,162
Oar, W. Lyman.....	169,277
Oil, apparatus for reducing crude, W. C. Parker.....	169,189
Oil, S. S. Newton.....	169,187
Ore, treating quicksilver, J. P. Steveling.....	169,198
Organ, octave coupler, S. J. Crockett.....	169,089
Packing box and crate, H. M. Simons.....	169,303
Packing, piston, C. R. James.....	169,174
Paclock, B. Walimann.....	169,211
Pan, cake, F. G. High.....	169,264
Paper tube machine, N. Keely.....	169,107
Pencil, colored copying, G. Schwanhauser.....	169,195
Planter, corn, B. King.....	169,176
Planter, corn, A. M. Southard.....	169,370
Planter, seed, J. W. Simpson.....	169,122
Plastering safety plate, G. A. Thurston.....	169,128
Plow attachment, G. M. Todd.....	169,313
Plowshare die, etc., W. M. Watson.....	169,213
Postage stamp, C. F. Steel.....	169,125
Power, motive, Brettell & Lindsey.....	169,233
Press, cotton, D. S. McBryde.....	169,183
Press, cotton, McMeekin & Hunt.....	169,184
Printing press, C. Wells.....	169,321
Printing press bearing, Potter & Hubbard.....	169,191
Propeller wheel, N. A. Patterson.....	169,287
Pulley or gear wheel, J. B. Mason.....	169,114
Pump box, J. Dillon.....	169,092
Pump bucket, E. J. Dunbar.....	169,155
Purifier, middlings, M. Sower.....	169,248
Railway, elevated, J. Westcott.....	169,222
Railway joint fastening, L. Chilson.....	169,237
Railway rail joint, G. E. Dering.....	169,226
Railway rail joint, W. H. Hornum.....	169,256
Railway rail joint, W. H. Robinson.....	169,238
Railway switch, W. L. Lamborn.....	169,274
Ratchet wheels, click for, E. H. Perry.....	169,190
Refrigerator, E. S. Blitzer.....	169,078
Refrigerators, E. B. Smith.....	169,335
Revolvers, safety catch for, C. W. Hopkins (r).....	6,715
Saddles, stirrup for riding, J. C. Wagstaff.....	169,209
Sash fastener, C. L. Alexander.....	169,222
Saw set, W. Burgess.....	169,144
Sawing machine, N. M. Miller.....	169,282
Scaffold, traversing, D. R. Kelly.....	169,270
Screw taps, machine for cutting, H. Boyd.....	169,080
Scythe snaths, bending, Russell & Birner.....	169,126
Seed and guano distributor, A. H. Simms.....	169,199
Sewing button holes, J. T. Jones.....	169,106
Sewing machine, T. B. Garretson.....	169,097
Sewing machine, bag, H. P. Garland.....	169,163
Sewing machine table, R. H. St. John.....	169,310
Sewing machine driver, J. Bolton.....	169,079
Shirt, C. M. and J. C. Ball.....	169,133
Skins, dressing, R. Hart.....	169,102
Smoke stack heating apparatus, T. B. Field.....	169,093
Smut machine, D. Pease.....	169,289
Socket coupling, A. S. Wadleigh.....	169,308
Soldering process, M. A. Richardson.....	169,192
Sole fastenings, nail for, L. Godda.....	169,257
Spinning machine, J. P. Hillard.....	169,170
Spiral level, and straight edge, J. G. Ralph.....	169,290
Spoon holder, Rabbitt & Beach.....	169,224
Stair for fire escapes, folding, T. Garrick.....	169,096
Stamp, perforating, W. G. Brown.....	169,143
Stench trap, dry, J. H. Boschen.....	169,232
Stone, artificial, W. H. Whittemore.....	169,218
Stove, H. E. Spurrer.....	169,205
Stove and furnace, P. Klotz.....	169,373
Stove bracket, wire, Randall & Newton.....	169,118
Stove, heating, Z. Hunt.....	169,172
Stove, heating, W. F. Ross.....	169,298
Stove, heating, J. Van.....	169,317
Stove pipe shelf, J. Christy.....	169,147
Stove, reservoir cooking, E. Card.....	169,096
Sugar cooling and draining, J. G. Angell.....	169,223
Suspender, S. K. Ellis.....	169,345
Syringe, W. P. Clotworthy.....	169,238
Telegraph, fire alarm, S. Chester.....	169,097
Tire upsetting machine, W. Holdsworth.....	169,305
Tobacco hanger, T. B. Garr.....	169,095
Track cleaner, J. Doman.....	169,241
Tray for beer glasses, etc., J. Novinsky.....	169,198
Trunk, A. V. Romadka.....	169,236
Turbine wheel, T. H. Clark.....	169,148
Type casting and setting, C. S. Westcott.....	169,215
Umbrella runner, J. M. Burkert.....	169,081
Vehicle axle, G. Beck.....	169,226
Vehicle runner, attachable, I. & W. G. Pettis.....	169,116
Vehicle springs, S. Gliringer.....	169,254
Vehicle rubber tyre, G. A. Greene.....	169,100
Velocipede, F. S. Seagrave.....	169,302
Ventilating buildings, L. R. Satterlee.....	169,300
Wagon, dumping, D. E. Davis.....	169,153
Wagon, dumping, A. A. Hoch.....	169,171
Wagon, infant's parlor, B. J. Harrison.....	169,168
Wagon spring, W. F. Whitney.....	169,323
Wash tub wringer, A. W. Caldwell.....	169,146
Washer, steam, M. Howe.....	169,104
Washers, machine for spring, J. W. Grover.....	169,303
Washing machine, P. A. Downer.....	169,242
Washing machine, P. Lieber.....	169,111
Water wheel, A. W. Haas.....	169,165
Water wheel, reversible, A. W. Lindley.....	169,112
Wind wheel, A. J. Beckley.....	169,227
Windlass, J. P. Mantou.....	169,182
Window screen, H. B. Walbridge.....	169,270

Wire feeding mechanism, R. L. Brewer.....	169,081
Yarns, tufted, H. Bottomley.....	169,139

DESIGNS PATENTED.

8,747.—CARPETS.—J. Barrett, New York city.	
8,748.—GASELIERES.—C. Herter, New York city.	
8,749 to 8,752.—EMBROIDERY PATTERNS.—W. Steinhaus, New York city.	
8,753 and 8,754.—CROCHET PATTERNS.—W. Steinhaus, New York city.	
8,755.—INKSTANDS.—S. J. Van Stavoren, Philadelphia, Pa.	
8,756 to 8,758.—SHIRT STUDS.—L. S. Beals, Astoria, N. Y.	
8,759.—DOOR PLATE.—J. Capron, New York city.	
8,760.—ROOF WERKING.—J. A. Greene, North Kingstown, R. I.	
8,761.—SHOE FRONTS.—C. Merritt, South Weymouth, Mass.	
8,762.—SHELF BRACKETS.—E. J. Steele, Westville, Conn.	
8,763.—ALBUM COVER.—W. Wallach, New York city.	

SCHEDULE OF PATENT FEES.

On each caveat.....	\$1.00
On each Trade mark.....	\$2.50
On filing each application for a Patent (17 years).....	\$15
On issuing each original Patent.....	\$20
On appeal to Examiners-in-Chief.....	\$10
On appeal to Commissioner of Patents.....	\$20
On application for Reissue.....	\$30
On filing a Disclaimer.....	\$10
On an application for Design (3 1/2 years).....	\$10
On application for Design (7 years).....	\$15
On application for Design (14 years).....	\$30

CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA, October 30 to November 2, 1875.

5,297.—J. B. Slichter, Kalamazoo, Mich., U. S. Elastic paint compound. Oct. 30, 1875.	
5,298.—J. B. Slichter, Kalamazoo, Mich., U. S. Fire-proof roofing cement. Oct. 30, 1875.	
5,299.—J. B. Slichter, Kalamazoo, Mich., U. S. Fire-proof paint compounds. Oct. 30, 1875.	
5,300.—J. H. Tackabery, East Tilbury, Ont. Spring buggy top. Oct. 30, 1875.	
5,301.—W. C. Peel <i>et al.</i> , Springfield, Ohio, U. S. Dash boards for vehicles. Oct. 30, 1875.	
5,302.—F. J. Wallace, Waterloo, Iowa, U. S. Mill dam. Oct. 30, 1875.	
5,303.—W. D. Bartlett, Amesbury, Mass., U. S. Heater furnace. Oct. 30, 1875.	
5,304.—W. Goodwin, Liverpool, Eng. Machine for the transfer of grain, etc. Oct. 30, 1875.	
5,305.—J. J. Catling, London, Ont. Draft stops for bottoms of doors. Oct. 30, 1875.	
5,306.—I. R. Venners <i>et al.</i> , Cumberland, Md., U. S. Machine for rolling tapered bars. Oct. 30, 1875.	
5,307.—R. Winder, Bolton, Eng. Type-composing machinery. Oct. 30, 1875.	
5,308.—D. C. Taylor <i>et al.</i> , Brooklyn, N. Y., U. S. Water meter. Oct. 30, 1875.	
5,309.—J. W. Branch, St. Louis, Mo., U. S. Fitting diamonds in holders, for working in stone. Oct. 30, 1875.	
5,310.—G. D. Belcher, Springfield, Mass., U. S., <i>et al.</i> Boat-ditching apparatus. Oct. 30, 1875.	
5,311.—J. B. Dixwell, Boston, Mass., U. F. Steam engine. Oct. 30, 1875.	
5,312.—J. C. Spencer <i>et al.</i> , Montreal, P. Q. Stench trap. Oct. 30, 1875.	
5,313.—A. Ost, Oswego, N. Y., U. S. Churn. Oct. 30, 1875.	
5,314.—W. A. Stephens, Succasuna Plains, N. J., U. S. Making wrought iron direct from the ore. Oct. 30, 1875.	
5,315.—T. Thornton, Saltburn, Eng. Door and gate closer. Oct. 30, 1875.	
5,316.—S. Wallace, Seaford, Ont. Double cheese box. Oct. 30, 1875.	
5,317.—G. P. Reeves, Helena, Mont. Ter., U. S. Lacer. Oct. 30, 1875.	
5,318.—G. M. Fuller, Holyoke, Mass., U. S. Machine for making water gas and sewer pipes. Oct. 30, 1875.	
5,319.—R. Gill, Antwerp, N. Y., U. S. Fence post. Oct. 30, 1875.	
5,320.—C. A. Chamberlin, Camden, N. J., U. S. Chain cable. Oct. 30, 1875.	
5,321.—J. Smale, Exeter, Ont. Seamless shoe. Nov. 2, 1875.	
5,322.—R. Sutherland, Shelburne, Ont. Machine for churning. Nov. 2, 1875.	
5,323.—E. E. Hargreaves, Sarnia, Ont. Exhaust fan. Nov. 2, 1875.	
5,324.—J. W. Lefferts, Baltimore, Md., U. S. Shoe-sole edge trimmer. Nov. 2, 1875.	
5,325.—C. E. Hill, New York city, U. S. Structure for piers, wharves, foundations, etc. Nov. 2, 1875.	
5,326.—D. M. Richardson, Detroit, Mich., U. S. Machine for scouring wheat, etc. Nov. 2, 1875.	
5,327.—H. Fowler, Detroit, Mich., U. S. Machine for cutting hoops. Nov. 2, 1875.	
5,328.—W. H. Seymour, Johnstown, N. Y., U. S. Scaffold clamp. Nov. 2, 1875.	
5,329.—G. B. Thurber, Upton Station, P. Q. Oscillating water and air pump. Nov. 2, 1875.	
5,330.—W. D. S. Moncrieff, Glasgow, Scotland. Locomotive car for tramways. Nov. 2, 1875.	
5,331.—W. H. Milliken, Sacramento, Cal., U. S. Traction engine. Nov. 2, 1875.	
5,332.—J. Elliott, Kittering, Eng. Sewing machine needle. Nov. 2, 1875.	
5,333.—W. P. Widdifield, Siloam, Ont. Car brake. Nov. 2, 1875.	
5,334.—P. Fitzgibbons, Oswego, N. Y., U. S. Tube expander. Nov. 2, 1875.	
5,335.—A. Crosby, New York city, U. S. Machine for cleaning flues. Nov. 2, 1875.	
5,336.—P. Cook, Detroit, Mich., U. S. Machine for cutting hoops. Nov. 2, 1875.	
5,337.—F. W. Bartlett, Buffalo, N. Y., U. S. Generating and purifying ozone. Nov. 2, 1875.	
5,338.—C. A. Henmick, Mitchell, Ont. Bending stuff for making well side cutters. Nov. 2, 1875.	
5,339.—D. Cameron <i>et al.</i> , Galt, Ont. Rotary bed wood planing machine. Nov. 2, 1875.	
5,340.—J. H. Connor, Brockville, Ont. Washing machine. Nov. 2, 1875.	
5,341.—F. J. Chubb, Guelph, Ont. Lime kiln. Nov. 2, 1875.	
5,342.—R. M. Eames, Albany, N. Y., U. S. Process for the reduction of ores.	
5,343.—E. E. O. Warner <i>et al.</i> , De Kalb, Ill., U. S. Baking pans. Nov. 2, 1875.	
5,344.—T. Booth, Toronto, Ont. Pipe wrench. Nov. 2, 1875.	
5,345.—W. Burrows, New York city, U. S. Ornamental stoves. Nov. 2, 1875.	
5,346.—J. Yocum, Dunville, Ont. Combination wrought iron plow beam. Nov. 2, 1875.	

OTIS' Machinery. SAFETY HOISTING
OTIS, BROS. & CO.
NO. 348 BROADWAY, NEW YORK.

Advertisements.

Back Page - - - - - \$1.00 a line.
Inside Page - - - - - 75 cents a line.
Engravings may have 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.

Engine, Spindle, & Cylinder Oil. E. H. KELLOGG, 17 Cedar St., N. Y. Manufacturers the best. Established '58.

Knife. Polisher, Can Opener, Sharpener. Agents wanted. Centennial Novelty 651 N. 7th St. Phila. Pa.

NO FILES ARE USED ON HOE'S CHISEL TOOTH SAWS. No sawing, no gumming, no rounding, nor side set to perplex the sawyer. They run straight, and are fifty per cent cheaper to use than the solid saw.

WIRE ROPE
Address JOHN A. DOBBLING & SONS, Manufacturers, Trenton, N. J., or 117 Liberty St., New York. Wire and Rope for conveying power long distances. Send for Circular.

DICKINSON'S ADJUSTABLE DIAMOND TOOL.
and Shaped Diamond Carbon Points, indispensable for turning Emery Wheels, Grindstones, also Truing up Hardened Steel and Paper Calendar Rollers, etc. Address J. DICKINSON, Patentee, 64 Nassau St., N. Y.

THE EXCELSIOR DRY LEVEL, valuable to every Mechanic. Plumb and Level combined. No glass to break, no cement to shrink. Warranted correct. Graduated for angles and measurements. H. S. TARR & SON, 710 Green St., Philadelphia, Pa.

NICKELPLATING BATTERIES, SALTS, etc., constantly supplied by L. FEUCHTWANGER & CO., 180 Fulton St., N. Y.

FREE
100 page Book and samples of Rubber Roofing. Complete materials for new roof, 4 1/2 x 8 ft. Fire-proof, durable, cheap. Easily applied with positive satisfaction. Write at once and save money. N. Y. Slate Roofing Co., Cedar St., N. Y.

For showing Heat of **Pyrometers**, Ovens, Hot Blast Pipes, Boiler fires, Super-Heated Steam, Oil Stills, &c. HENRY W. BULKLEY, Sole Manufacturer, 38 Liberty St., New York.

IRON PYRITES, free from Arsenic, in quantities, cheap. Box 20, Brockville, Ont.

With Disston's Saws.
Sold by Hardware Trade. LANGDON MITRE BOX CO., Millers Falls, Mass.

EXPERIENCED MILL MEN, who are using E. R. HOE & CO.'S New Patent Saws, concur in saying that the chisel tooth is very superior, and will soon supersede all other circular saws, for cutting logs and timber.

ENGINES & BOILERS, new & 2d h'd. perfect condition. Very cheap. Address BINGHAM & RICH, 101 Chy. Pa.

Corrugated Iron
Iron Buildings, Roofs, Shutters, Doors, etc. MOSELY IRON BRIDGE AND ROOF CO., Office 5 Dey St., New York. Send for circulars.

THE CHRISTIAN UNION.
REV. HENRY WARD BEECHER, Editor.

Ellinwood's authorized verbatim reports each week of Mr. Beecher's **Sermons in Plymouth Church**. All his literary productions, including the characteristic "STAR PAPERS," will be given. Serial Stories by REV. EDWARD EVERETT HALE, D.D., (Author of "A Man without a Country," &c.)

HON. ALBION W. TOURGEE, Judge of the Superior Court of North Carolina, (Author of "Tolnet," &c.)

MRS. HARRIET BEECHER STOWE, (Author of "Uncle Tom's Cabin," &c.)

A Comprehensive Family Religious Newspaper. Terms \$3.20 per year, postage prepaid.

New and Unusual Terms to Agents.
Cash Commissions and Competitive Premiums in Cash.

\$2,000 Given Away!
Send for particulars.

HENRY M. CLEVELAND, Publisher.
HORATIO C. KING, Asst. Publisher.
37 Park Place, New York.

R. HOE & CO.'S CHISEL TOOTH SAWS ARE run with thirty per cent less power than the average of saws. A dull set of teeth may be removed and sharp ones inserted in five minutes. Cost, three cents per tooth.

NOYE'S Mill Furnishing Works
are the largest in the United States. They make Burr Millstones, Portable Mills, Hand Machines, Packers, Mill Picks, Water Wheels, Pulleys and Gearing, specially adapted to four mills. Send for catalogue. J. T. NOYE & SON, Buffalo, N. Y.

Just Out.

WRINKLES AND RECIPES,

COMPILED FROM THE

Scientific American

An Illustrated Hand-Book of Practical Hints and Suggestions for Mechanics, Engineers, Farmers, Housekeepers, and Workmen generally.

EDITED BY PARK BENJAMIN.

Contents.

DEPARTMENT OF MECHANICS.
Master-Tools, accurately represented. How to make and use them. Valuable suggestions for management of Machine Tools. Hints for Casting, Forging, Tempering, etc. Trade Secrets and Wrinkles. The whole supervised by JOSHUA REBE.

DEPARTMENT OF ENGINEERING.
The management, construction, and repair of Boilers, Engines, Valves, Shafts, Belts, Pulleys, and Hangers. Brief rules for practice, etc., prepared by Mr. R. H. BURL. Also, New Paper on Testing Metal, expressly written by PROF. R. H. THURSTON, C.E., who also supervises the entire Department.

DEPARTMENT OF PRACTICAL TECHNOLOGY.
Supervised by PROF. P. H. VANDER WEYDE, M.D. Metallurgical Operations; Cements and Glazes; Painting and Varnishing; Making simple Instruments, etc., etc. Hundreds of Recipes for every variety of Industrial Work.

DEPARTMENT OF THE FARM.
How to construct Farm Buildings. The Dairy. Hints for care of Stock, about Manures, Plants, Vegetables, Trees, Farm Machinery, etc., etc.

DEPARTMENT OF THE HOUSEHOLD.
Cleaning Processes of all kinds. Window Gardens. Destruction of Vermin. Care of China, Glass, and Furniture. Papering Walls. Simple Remedies, etc., etc.

The volume comprises 250 pages, is printed on fine paper, with gilt edges, and is of large pocket-book form, flexible covers, neatly ornamented.

Mailed, post paid, on receipt of \$1.50.
1 copy Scientific American, 1 year, and 1 copy Wrinkles and Recipes.....\$4.20

Address
H. N. MUNN,
PUBLISHER,
P. O. BOX 72,
37 Park Row, New York City.

HARTFORD STEAM BOILER
Inspection & Insurance

COMPANY.
W. B. FRANKLIN, V. P. J. M. ALLEN, Pres.
J. R. FRANKLIN, Sec.
HARTFORD, CONN.

The PORTER-ALLEN ENGINE.
POSITIVE-MOTION VARIABLE CUT-OFF.
RAPID PISTON SPEED.
Send for a circular to CHARLES T. PORTER, Harlem, N. Y. City.

THE NATIONAL Steel Tube Cleaner.
PATENTED JULY 28 1874.
Adopted and in use by U. S. Navy. For sale by dealers. Send for Circular. THE CHALMERS SPENCE CO., foot E. 9th Street, N. Y. Agents for the U. S.

NON-COMBUSTIBLE STEAM BOILER & PIPE COVERING
WITH AIR SPACE IMPROVEMENT.
Saves 10 to 20 per cent. CHALMERS SPENCE CO., foot E. 9th St., N. Y.; 1202 N. 2nd St., St. Louis, Mo.

W. C. DUYCKINCK,
IMPORTER, MANUFACTURER, AND DEALER IN
Railway, Machinists' and Engineers' Supplies,
50 AND 52 JOHN STREET,
P. O. BOX 401, NEW YORK.

REYNOLDS & CO.,
145 EAST ST., NEW HAVEN, CT.,
MANUFACTURE
Iron and Steel Set Screws, Round, Square, and Hexagon Head; Machine and Cap Screws; Piano, Knob, and Lock Screws; Machine, Bridge, and Roof Bolts, Bolt Ends, Blanks, Nuts, Washers, etc., of every description. Send for Price List.

THE TANTITE COMPANY
Emery Wheels, Emery Grinders, STROUDSBURG, MONROE CO. PA.
PURE EMERY.
guaranteed equal to any in the market at prices lower than any other first class emery.

Schlenker's Stationary
AND
Revolving - Die Bolt Cutters,
MANUFACTURED BY THE
HOWARD IRON WORKS,
BUFFALO, N. Y.
Send for Circular.

TRADE MARK.
CONCORD CENUINE CONCORD AXLES
The Standard - Best Stock - Finest Finish.
MANUFACTURED ONLY BY
D. ARTHUR BROWN & CO., Fisherville, N. H.

MAGNETS - Permanent Steel Magnets
of any form or size, made to order by F. C. BEACH & CO., 246 Canal St., New York. Makers of the celebrated Tom Thumb and Miniature Telegraph Instruments.

DITCHING and EXCAVATION.
RANDOLPH'S DITCHER AND EXCAVATOR: Simple, strong, and adapted to all soils reasonably free from stumps or large stones. Will do the labor of 100 men, steadily, at the cost of ten. Machines of all sizes, cutting from three inches wide, three feet deep, to 36 inches wide, four feet deep. Extra sizes made to order. Circulars, &c., sent on application to RANDOLPH BROS., 111 Broadway, New York.

TO DYERS AND MANUFACTURERS.
Thomas's Fluid Tannic Acid, or Black Color Base, for Coloring Hats, Carpets, and Felt Goods, and Textile Fabrics, and for making Ink. Price 6c. per lb. Address N. SPENCER THOMAS, Elmira, N. Y.

THE BEST INJECTOR
For Locomotive and Stationary Boilers.
FRIEDMANN'S PATENT.
Over 15,000 Now in Use Here and in Europe.
Throws more and hotter water, with less steam, than any others. It has two Waterways, fixed Nozzles, and no movable parts to get out of order.

NATHAN & DREYFUS, Sole Manufacturers,
108 Liberty St., New York.
Send for Catalogue.

ROGERS' TANNATE OF SODA BOILER SCALE PREVENTIVE. JOS. G. ROGERS & CO., Madison, Ind. Send for book on Boiler Incrustation.

Portland Cement.
From the best London Manufacturers. For sale by JAMES BRAND, 35 CHIT ST., N. Y.
A Practical Treatise on Cement furnished for 25 cents.

Excelsior Do Your Own Printing
Portable \$3 Press for cards, labels, envelopes, etc. Larger sizes for larger work.
Businessmen do their printing and advertising, save money and increase trade. Amateur Printing, delightful pastime for spare hours. BOYS have great fun and make money fast at printing. Send two stamps for full catalogue presses type etc to the Mfrs KELSEY & CO., Meriden, Conn.

THE SOUTHERN STATES AGRICULTURAL AND INDUSTRIAL EXPOSITION
Will be held on the Fair Grounds, at New Orleans, commencing February 26, 1876, and continuing Ten Days.
L. N. MARKS, PRESIDENT.
SAMUEL MULLEN, GENERAL SUPERINTENDENT.

Executive Committee.
A. BALDWIN, Chairman; W. B. SCHMIDT, JOHN G. FLEMING.
JAMES I. DAY, COLONEL J. D. HILL.

It is the aim of the Board of Commissioners to make it a thorough Exposition of the Agricultural and Mechanical Products of the Southern States, Mexico, and Central America; but it will be open to competitors throughout the country, and the general premium list will embrace all articles comprehended in the general design of an Agricultural and Industrial Exposition, including special premiums for strictly Southern products.

The Mechanical Department has been devised with great care and on the most extensive scale. The Premium List will be ready for distribution November 20th. Ample arrangements have been perfected for the transportation of goods and visitors from every section at reduced rates. For detailed information, address SAMUEL MULLEN, GEN'L SUP'T, No. 80 Camp St., New Orleans.

RICHARDSON, MERIAM & CO.,
Manufacturers of the latest improved Patent Daniels' and Woodworth Planing Machines, Matching, Bash and Molding, Tenoning, Mordising, Boring, Shaping, Vertical and Circular Re-sawing Machines, Saw Mills, Saw Arbors, Scroll Saws, Railway, Cut-Off, and Rip-saw Machines, Spoke and Wood Turning Lathes, and various other kinds of Wood-working Machinery. Catalogues and price lists sent on application. Manufacturing, Worcester, Mass. Warehouse, 107 Liberty Street, New York.

Machinery of Improved Styles for making SHINGLES, HEADING AND STAVES.
Sole makers of the well known IMPROVED LAW'S PATENT SHINGLE and HEADING SAWING MACHINE. For circulars, address THEVOR & CO., Lockport, N. Y.

DAMPER BEST AND LEVER REGULATORS
GAGE COCKS.
MURRILL & KEIZER, 44 Holliday St., Balt.

IRON PLANERS.
ENGINE LATHES, DRILLS, &c. Send for Price List.
NEW HAVEN MANUFACTURING CO., New Haven, Conn.

PORTLAND CEMENT
For Walks, Cisterns, Foundations, Stables, Cellars, Bridges, Reservoirs, Breweries, etc.
Remit 6 cents postage for Practical Treatise on Cements. S. L. MERCHANT & CO., 76 South St., New York.

THOMAS'S FLUID TANNATE OF SODA -
Never fails to remove Scale from any Steam Boiler, using any kind of water. It is in Barrels 500 lb., 4 Bbls. 200 lb., 4 Bbls. 125 lb. Price only 25c. per lb. Address N. SPENCER THOMAS, Elmira, N. Y.

BOGARDUS' PATENT UNIVERSAL ECKEN-TRIC MILLS -For grinding Bones, Ores, Sand, Old Crucibles, Fire Clay, Guano, Oil Cake, Feed, Corn, and Cob, Tobacco, Snuff, Sugar, Salts, Roots, Spices, Coffee, Coconut, Flaxseed, Almonds, 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.

T. V. Carpenter, Advertising Agent. Address Box 72, New York City.

Munn & Co.'s Patent Offices.

Established 1846.

The Oldest Agency for Soliciting Patents in the United States.

TWENTY-EIGHT 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 draftsmen 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 Streets, Washington. They also prepare and file caveats, procure design patents, trademarks, 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: in fact attend to every branch of patent business both in this and in foreign countries.

Patents obtained in Canada, England, France, Belgium, Germany, Russia, Prussia, Spain, Portugal, the British Colonies, and all other countries where patents are granted.

Copies of Patents.
Persons desiring any patent issued from 1836 to November 26, 1867, can be supplied with official copies at a 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 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.

A pamphlet of 110 pages, containing the laws and full directions for obtaining United States patents, also a circular pertaining exclusively to Foreign Patents, stating costs in each country, time granted, etc., sent free. Address

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

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

PROSPECTUS
OF THE
SCIENTIFIC AMERICAN,
FOR 1876.

THE MOST POPULAR SCIENTIFIC PAPER IN THE WORLD.

THIRTIETH YEAR
VOLUME XXXIII - NEW SERIES

The publishers of the SCIENTIFIC AMERICAN beg to announce that on the third day of July 1876, a new volume 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.

The SCIENTIFIC AMERICAN is devoted to the interests of Popular Science, the Mechanic Arts, Manufactures, Inventions, Agriculture, Commerce, and the industrial pursuits generally; and it is valuable and instructive not only in the Workshop and Manufactory, but also in the Household, the Library, and the Reading Room.

TERMS.
One copy, one year (postage included).....\$3.20
One copy, six months (postage included).... 1.60
One copy, three months (postage included).... 1.00
One copy of Scientific American for one year, and one copy of engraving, "Men of Progress"..... 10.00
One copy of Scientific American for one year, and one copy of "Science Record" for 1876..... 5.20
Remit by postal order, draft, or express.
Address all letters and make all Post Office orders and drafts payable to

MUNN & CO.
37 PARK ROW, NEW YORK.

THE "Scientific American" is printed with CHAS. ENCK JOHNSON & CO., 9 N. E. 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. XXXIII.—No. 23.
(NEW SERIES.)

NEW YORK, DECEMBER 4, 1875.

[\$3.20 per Annum.
(POSTAGE PREPAID.)

THE HUDSON RIVER BRIDGE AT TROY, N. Y.

We herewith give an illustration of the bridge which crosses the Hudson and connects Troy with West Troy. It was designed by Mr. Alfred P. Boller, and is the largest highway bridge ever built in this land of great bridges, excepting the truly magnificent Girard avenue bridge, by Clarke, Reeves, & Co., at Philadelphia. The bridge consists of (measurements from center of piers): 2 spans, 244 feet,

Pittsburgh *Evening Chronicle*, is "the greatest mechanical curiosity we have ever examined, inasmuch as we are utterly unable to conceive, much less comprehend, the means employed to produce the extraordinary results attained in a brief space of time. This is dubbed the Hydro-Pneumatic Puzzle, and was originally designed for the Centennial, where it will excite a degree of attention such as is seldom accorded to mechanical contrivances. This puzzle is constructed wholly

rently it weighs seventy pounds, perhaps less. A water gage and an air gage are attached. When the pressure derived from the city reservoir is employed (about 45 lbs. to the inch) the vapor or air gage, in a very few minutes succeeding, indicates rapidly 500, 1,000, and finally 5,000 lbs. to the square inch! Now, the conundrum we submit to the mechanic is: How is the result brought about? There is absolutely no movement in the pneumatic puzzle perceptible to human



BRIDGE OVER THE HUDSON AT TROY, N. Y.

488 feet, 1 span, 226 feet; 1 pivot draw, 258; 1 span, 85; 1 span, 65; total, 1,122: not including the masonry approaches at either end, bringing the grade up to 34 feet above ordinary water mark. All the masonry was designed and its execution superintended by the engineer, Colonel G. Haward Ellers, and is thoroughly first-class rock-faced ashlar work. The piers are all founded on a grillage supported on piles cut off at the river bottom, about 10 feet below ordinary stages of water.

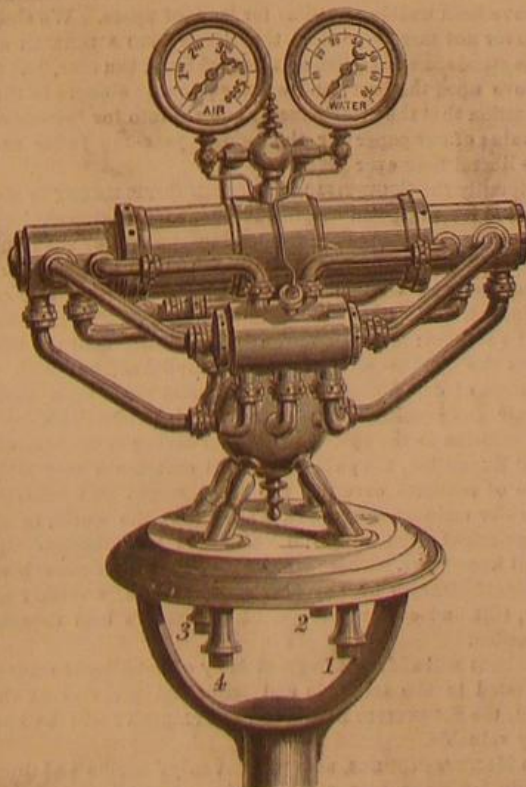
The flooring of the superstructure is 37 feet wide, of which 24 feet is taken up by the double roadway. The trusses are placed 25 feet 9 inches between centers, and are so designed as to have all constructive details of wrought iron. All the rivets are accessible for painting and inspection, and have made and pin connections, thus embodying the best features of the riveted and pin connection systems.

The draw span is proportioned on the theory of a continuous girder supported at center when closed, modified by the always existing open draw strains. The pivot on which the draw swings is a Parry anti-friction pivot, made by Sellers and Co., Philadelphia. All the weight is carried to the center by means of a system of horizontal radial struts and diagonal ties, pulling against a double web wrought iron drum 3 feet deep. Although weighing some 250 tons, one man on a still day can handle this draw of 258 feet in length with perfect ease. The ends are supported by means of folding wedges, operated by line-shafting of gas pipe, each way from center of bridge. The rolling load for which the whole structure has been proportioned is 2,500 lbs. per lineal foot.

The Tradesmen's Industrial Institute,---Keely Out-Keelied.

The first exposition of the Tradesmen's Industrial Institute of Pittsburgh, Pa., from October 7 to November 6, was a pronounced success, and will doubtless be regularly held hereafter. The display of industrial works and specimens was very fine. The brass work and steam and mechanical instruments of Bailey, Farrell & Co., were especially excellent; and there was one exhibit by this firm which, says the

of brass, is composed of a small cylinder, supported by and connected with a series of tubes, scarcely more than an inch in diameter, placed at regular intervals, similar in curvature, and all describing and reproducing Hogarth's line of beauty



THE HYDRO-PNEUMATIC PUZZLE.

in outline. The cylinder is sixteen inches long, the apparatus is fifteen inches high, and about twelve in width. Appa-

eye. The mystery is concealed in the cylinder and tubes. It would be as easy to run the pressure up to 10,000. We observed this water or vapor devil a moment, and were inclined to call for Keely, when it occurred to us that it out-Keelied Keely.

"Next to this really remarkable mechanical device, we think the specimen of Knowles' pump near by is the most attractive article. What with the silver plating, the perfect fitting, and the thoroughness and degree of finish displayed, it is the most noteworthy piece of complete mechanism in the exposition."

Since the above was put in type, the manufacturers above mentioned have sent us a photograph of the curious "puzzle," which we have engraved.

In their letter to us, Messrs. Bailey, Farrell & Co. say: "The machine carries a 'cold vapor' gage marked up to 5,000 lbs., and a gage to register the water pressure applied and marked up to 70 lbs. The pipe, 1, is the inlet for water pressure from the city main; 4 is the water outlet or waste; 2 is the inlet for air; 3 is the outlet for air or 'cold vapor,' if you see fit to call it that. Having the Keely motor contrivance fresh in our minds, we prefer to make no statement in regard to the machine whatever, and we put it on exhibition as the 'What Is It?' or 'The Hydro-Pneumatic Puzzle.' Let those who can make it out. It was made for and will be exhibited at the Centennial. When we make public the workings of the machine we will write you. It is on public exhibition, not running for 60 seconds, but right along. We prefer not to solve our own puzzle."

We are sorry that our Pittsburgh friends should, like the Keely people, decline to explain how the trick is done. But perhaps the mind's eye of some of our ingenious readers, with the data given, can penetrate the brass cylinders, ascertain the interior construction, sketch, and send it to the SCIENTIFIC AMERICAN.

J. P. N. says: "I would state that the experience in New York State, with a class of water wheels which carry an immense load upon the stepping, indicates that the dyewood fustic is incomparably the best wood for bearings."

Scientific American.

MUNN & CO., Editors and Proprietors.

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

O. D. MUNN.

A. E. BEACH.

TERMS.

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

Club Rates.

Ten copies, one year, each \$2 70, postage included.....\$27 00
Over ten copies, same rate each, postage included..... 2 70

By the new law, postage is payable in advance by the publishers, and the subscriber then receives the paper free of charge.

NOTE.—Persons subscribing will please to give their full names, and Post Office and State address, plainly written, and also state at which time they wish their subscriptions to commence, otherwise the paper will be sent from the receipt of the order. When requested, the numbers can be supplied from January 1st, when the volume commenced. In case of changing residence, state former address, as well as give the new one. No changes can be made unless the former address is given.

VOLUME XXXIII., No. 23. (NEW SERIES.) Thirtieth Year.

NEW YORK, SATURDAY, DECEMBER 4, 1875.

Contents.

(Illustrated articles are marked with an asterisk.)

Alloy balance.....	361	Hydropneumatic puzzle, the.....	351
Answers to correspondents.....	361	Inventions, miscellaneous.....	361
Astronomical notes.....	360	Ironclad vessels.....	359
Awl handles.....	361	Irrigation.....	360
Awning.....	361	Keely, another rival for.....	358
Axe tester.....	361	Keely out-keeled.....	360
Axe marks, etc.....	361	Krupp and his guns.....	360
Baggage checks.....	361	Light, improved dioptric.....	355
Barometograph, the.....	361	Locomotive, starting a (5).....	360
Belting abroad, American.....	354	Locomotives working gradients.....	354
Belting re. frictional gearing.....	357	Magnets, iron for, etc. (16).....	363
Belts, rubber, slip of (11).....	353	New books and publications.....	362
Blind hinge, improved.....	353	Norway, from.....	363
Boilers not in use (7).....	353	Oil, testing the fatty.....	360
Brass for boxes (12).....	353	Optimism, trying.....	360
Brass wire for rivets.....	358	Paint for hard-finished walls (14).....	361
Bridge at Troy, N. Y.....	351	Patents, American and foreign.....	362
Burglar alarm.....	353	Patents, official list of.....	363
Business and personal.....	353	Pattern core boxes (17).....	363
Carbonic acid from roots.....	353	Patterns for scroll saw work.....	363
Castings and patterns (6).....	353	Poison stories, curious.....	353
Cement for emery and cast iron (9).....	353	Pulley block, improved.....	354
Cow tail holder.....	355	Recipes, useful.....	357
Culinary apparatus, new.....	358	Rhinoceros, skinning a.....	356
Disease, the money equivalent of.....	353	Sadiron, improved.....	358
Electricity from the clothes (2).....	356	Seeds, the germination of.....	359
Electric light and heat.....	356	Sewing machine monopolists, the.....	358
Elephants, a plea for the wild.....	357	Sounding apparatus, new.....	357
Engine, oil, the Brayton.....	357	Steam, cutting off and throttling.....	357
Engraving tools, hardening.....	353	Steel ships in England.....	357
Exposition, the International.....	352	Swedenborg as a chemist.....	354
Fires, extinguishing by steam.....	358	Taps, heads of.....	358
Floors, polishing (14).....	353	Taps, thread-cutting by.....	358
Garbage, use for New York.....	353	Testotallers, argument for.....	352
Gear cutting, index for (10).....	353	Telegraph, wire for (15).....	363
Gold jewelry, coloring (4).....	353	Ventilating by machinery.....	353
Governor, improved.....	354	Volcanic action, source of.....	353
Gun barrels, twisted (15).....	353	Water gas delusion, the.....	352
Health Association, the Public.....	353	Water wheel bearings.....	351
Horse disease, the.....	353	Woodwork, the protection of.....	357

PUBLISHERS' CARD.

The present volume of the SCIENTIFIC AMERICAN is drawing rapidly to a close. Three numbers (including the present) and the year will be ended. Some eighteen thousand of our subscribers will find, printed on their wrappers covering this week's papers, the announcement that their subscriptions are about to expire, and the request that they will remit for the new volume. To prevent any break in the continuity of their subscriptions, and to enable the publishers to know how large an edition to print at the commencement of the year, subscribers are invited to remit for a renewal as early as possible. Simultaneously with the mailing of this week's paper, an envelope, containing Prospectus for 1876, a beautiful chromo Name List, a Catalogue of our Publications, and an Illustrated Hand Book, useful for inventors and others, will be mailed to all our subscribers; and we hope to receive all the lists back again filled with the names of those who wish in the future to take our paper.

To save our friends all the trouble possible, we also inclose an envelope with our address printed thereon, so that all the subscriber and getter-up of a club has to do, is to place his name or list of subscribers in the envelope, with the postal order, draft, or money, put a 3 cent stamp on the former, and drop it into his post office.

The terms of subscription remain as heretofore—\$3.20 per annum, postage prepaid by us, for single subscribers, with discount for a number. See terms for clubs in special prospectus. All news dealers throughout the country will, as usual, receive subscriptions and have our publications on sale.

THE GREAT INTERNATIONAL EXPOSITION.

The coming Centennial Anniversary of our existence as a nation, celebrated as it will be by the grandest display hitherto seen of the world's natural and industrial products, will have something more than a political interest and significance.

The century just closing has been a century unique and unrivaled for its contributions to the mental and material advancement of humanity; a century in which the Sciences, pure and applied, have passed from the stage of weakness, uncertainty, and general neglect to the very forefront of human progress, creating in their passage an entirely new

type of civilization and adding more to human power and comfort than all the agencies that had previously been brought to bear on them. As never before, man is master of Nature's materials and forces, and mainly through the achievements of the past hundred years.

What the coming century has in store for us, what advances man is destined to make in knowledge and power, it is impossible to forecast; it is nevertheless easy to see that what has been done and gained is little more than the prelude to the more magnificent achievements the future will have to record. It is therefore a peculiarly appropriate time, as we celebrate the first centennial year of our history, to review not merely what we have accomplished during our years of national infancy, but to compare our present standing in material wealth and progress with that of the other leading countries of the world.

To those who can spend the summer at Philadelphia—and nothing less will suffice to enable one to master the wealth of instructive matter to be gathered in the extensive halls of the Exhibition—the opportunity there afforded to become directly familiar with the present state of the world's industrial advancement will be incomparably superior to anything ever offered before on this continent, or likely soon to be presented elsewhere. But of the hundreds of thousands who will through the Exhibition Buildings, not many will be able to spend more than a few days at most in them—scarcely time for the mastery of a single department. For the multitude to reap the full benefit of its display of the world's resources, the Exhibition must be brought, so to speak, to their own doors.

The more enterprising newspapers will report and the illustrated papers will picture the daily occurrences of the Exhibition, its current incidents and gossip, its pomp and show, its hourly doings, and its features of temporary interest. But its substantial results—those matters which the engineer, the inventor, the manufacturer, the artisan, the man of practical science, the merchant, and the man of general scientific taste and culture will care most to know about—will lie without the sphere of the popular press. Yet it will be to the large and rapidly increasing portions of the reading public represented by such men that the Exhibition will appeal most directly and powerfully; they will have the largest stake in its collections, and will be able to derive the most immediate advantage from the varied instruction the Exhibition is intended to furnish.

It is the purpose of the publishers of the SCIENTIFIC AMERICAN to provide for the Centennial wants of this large and intelligent class, and to do for the substantial features of the Exhibition what the popular press will do for the incidental and trivial.

While the regular edition of the SCIENTIFIC AMERICAN will convey to our readers, every week, an extensive and most interesting general view of the Exposition, our ordinary space will be inadequate for a large remainder of scientific information, deserving of record. We have concluded to meet the emergency by issuing a SCIENTIFIC AMERICAN SUPPLEMENT, to begin with the first of January next. It will consist of sixteen large quarto pages, issued weekly, richly illustrated and printed in the best style, uniform with the SCIENTIFIC AMERICAN, but in effect a separate and independent publication. The terms of single subscriptions to the SCIENTIFIC AMERICAN SUPPLEMENT will be \$5.00 a year by mail. The two papers, the SCIENTIFIC AMERICAN and the SUPPLEMENT, will be furnished together for \$7.00 a year, postage paid by us.

It must not be inferred from this announcement that the SCIENTIFIC AMERICAN SUPPLEMENT will infringe in any respect upon the field now occupied by the SCIENTIFIC AMERICAN. It will be strictly what its name implies, presenting, so to speak, the overflow of valuable matter which heretofore we have been unable to utilize for lack of space. We shall endeavor not merely to hold the SCIENTIFIC AMERICAN up to the standard of excellence it has achieved thus far, but to improve upon the past; and we may properly observe in this connection that the arrangements entered into for increasing the value of our paper for the coming year are fuller and more liberal than ever before.

Primarily the SCIENTIFIC AMERICAN SUPPLEMENT is designed to illustrate and describe the many interesting subjects and objects presented in the various departments of the Exhibition with great fullness and detail, with such an abundance of engravings and working drawings as will place the natural and industrial riches of the Exhibition clearly and vividly before its readers; not, however, as a dry catalogue of the best things the genius of man has accomplished, but with a liveliness of description that will interest more than those directly and specially connected with industrial affairs.

In addition to the special matter pertaining to the International Exposition, the publication will embrace a very wide range of contents covering the most recent and valuable papers by eminent writers, in all parts of the world, in all the principal departments of scientific investigation and useful knowledge. There will thus be, what has never been attempted hitherto by any single publication, a weekly review, full and comprehensive, of the world's best thought and action.

While it will address the great body of intelligent readers interested in the scientific and industrial progress of the world, the SCIENTIFIC AMERICAN SUPPLEMENT will be specially valuable.

To MANUFACTURERS, as it will not only describe and illustrate in detail the best machines introduced into each and every branch of mechanical production, but, in the department of Technology, will furnish early information of all new and useful inventions and discoveries relating to the chemical and mechanic arts.

To METAL WORKERS, as the department of chemistry and metallurgy will embrace accounts of all the chief chemical discoveries and improvements in the process of working the various metals, with engravings of new apparatus, descriptions of new alloys, and much other related information.

To ENGINEERS, since it will furnish the latest and best papers upon steam engineering, railway engineering, mining and civil engineering, millwork, textile industry, etc., with engravings and working drawings, besides full accounts of the latest improvements in telegraphy and telegraph engineering, in electric batteries and engines, and all new and useful applications of electricity in the Arts.

To ARCHITECTS, as it will furnish examples of the best new structures, with details and drawings of plans, elevations, etc., with a large amount of information relating to the production and improvement of builder's materials, and collateral matters.

To STUDENTS and SPECIALISTS, inasmuch as, while it will furnish the latest intelligence of inventions, discoveries, and improvements in each department of scientific thought and enterprise, it will aim not only to keep the specialist promptly advised of all that is best worth knowing in his particular department, but will furnish from week to week such a general review of human progress as to enable him to keep the run of the Sciences with the least outlay of time and money.

The advantages which the SCIENTIFIC AMERICAN SUPPLEMENT will offer to advertisers, either for addressing special classes of men or the intelligent public at large, cannot be surpassed. The classes to which it will be addressed will comprise the most active and well-to-do portion of the community: the higher ranks of producers: men of genius and energy: large buyers and extensive consumers of raw and manufactured material. And as each number of the SUPPLEMENT will have a permanent value, its announcements will remain a permanent source of suggestive reminders. The superior value of such persistent advertisements needs no arguments.

We shall issue the first number of the SCIENTIFIC AMERICAN SUPPLEMENT some days in advance of its actual date, in order to meet the large demand for specimen copies. For additional particulars, see prospectus in another column.

THE WATER GAS DELUSION AGAIN.

This old device has been revived, and is now on exhibition in Brooklyn and a few other places. It consists simply of an inverted bell jar plunged in a vessel containing diluted sulphuric acid and zinc. The water is decomposed into its constituents, oxygen and hydrogen. Free hydrogen gas escapes, while the oxygen of the water combines with the zinc to form oxide of zinc, which, in its turn, combines with the sulphuric acid to form a soluble salt. The operation, therefore, results in liberating hydrogen from water, and changing the zinc and free sulphuric acid in the water into a solution of sulphate of zinc.

The value of this process depends, like that of most other inventions, on the expense attending it. If the cost of production is less than that of common gas, or equal to it, or even slightly above it, the water gas may compete with the coal gas, as the convenience of being independent of the gas works is worth something. But if the cost is more than \$27 per thousand cubic feet, while common gas costs \$3, less than one ninth, it is evident that water gas can never hope to meet with popular favor. The calculation of expense is simple enough to any one acquainted with the fundamental principles of chemistry. The chemical equivalent of zinc is 64, that of water 18, and of the constituents of water, oxygen and hydrogen, 16 and 2, respectively. Therefore if we wish to decompose water, by means of zinc, into its constituent elements, it takes 64 lbs. of zinc to decompose 18 lbs. of water, by combining with its 16 lbs. of oxygen and liberating its 2 lbs. of hydrogen. Therefore for every 2 lbs. of hydrogen liberated, we must consume 64 lbs. of zinc, which will be changed into 80 lbs. of oxide of zinc. But the process cannot go on without an acid to dissolve the oxide of zinc; and for this purpose the cheapest and best is sulphuric acid, of which the atomic weight is 80; therefore 80 lbs. of acid will be required, to combine with 80 lbs. of zinc, and the result will be a solution of 160 lbs. of sulphate of zinc. Let us now estimate the expense of producing these 2 lbs. of hydrogen gas. The 64 lbs. of zinc will cost, at 9 cents per lb., \$5.76; 80 lbs. of absolute sulphuric acid is required, and about 150 lbs. of the hydrated commercial acid will be needed, at 2½ cents per lb., costing \$3.75. Total, \$9.51. For this amount we have 2 lbs. of hydrogen gas; and in order to calculate its value in cubic feet, we consider that one cubic foot of water weighs 64 lbs., that air is 750 times lighter than water, and hydrogen 15 times lighter than air, or $15 \times 750 = 11,250$ times lighter than water. Therefore 11,250 cubic feet of hydrogen will weigh 64 lbs.; and dividing both these numbers by 32, we find that 350 cubic feet of hydrogen will weigh 2 lbs.; and as 2 lbs. cost \$9.51, that sum is the price of 350 cubic feet of hydrogen, while, according to this, 1,000 feet of hydrogen will cost \$27.17.

But this is not all. The hydrogen burns with a pale, almost invisible flame, and must be passed through a carbonizer, consisting of a vessel containing turpentine, gasoline, benzole, or some other volatile hydrocarbon, in order to make it luminous. But we will assume that the cost of this is covered by the value of the sulphate of zinc solution, which might be sold to a chemist, for evaporation and crystallization into dry sulphate of zinc. It is, however, almost worthless, as the large amount of the salt put into the market by the telegraph offices makes the product of little account.

CURIOUS POISON STORIES.

A story is going round the daily press, to the effect that a man once spit into a rattlesnake's mouth, and the snake died; he did the same thing to an adder, and it died also. Another adder would not open its mouth, so he spit on a stick, rubbed the spittle on the adder's nose, and it died. A non-poisonous black snake was treated in the same way, but it did not die; and the conclusion is drawn that human saliva is as poisonous for poisonous snakes as the poison of snakes is for man.

In order to realize the improbability of this story, we will state that the poison of snakes is not their saliva, but a special fluid secreted in a bag situated near the root of the poisonous fang, which is provided with a channel to conduct the poison from the bag to near the point, so that it may be injected into the wound.

Many poisons, dangerous if given by injection, are harmless in the stomach, where, by the digestive powers of the gastric and other juices, they are decomposed and made harmless. So the vaccine virus, which by inoculation produces the well known ulcer, is perfectly harmless when swallowed; and several other organic poisons, especially of the septic kind, of animal origin, are only dangerous when entering the system by a wound, and may with impunity be taken into the mouth and stomach. An excoriation or scratch on the lips or tongue, by which they may enter the circulation, is dangerous, as has been proved by many examples. Hence the danger of wounds during dissection by medical students, by which the decomposed animal matter of the subject enters the circulation, and kills the poor victim rapidly; while students with an unimpaired skin on their hands may dissect any subject with impunity. A case is on record of a young lady who kissed the dead body of her father. She had a little excoriation on her lip, which was touched by the moisture on the lips of the corpse; it soon inflamed with all the characteristics of a virulent dissection wound, and in a few days she was a corpse also. The poison had entered into the circulation of her blood.

Experiments in this line are of course highly objectionable; but as far as experience has shown, most poisons of this kind may with impunity be taken in the stomach. If the saliva of man or animals has any dangerous qualities, it is mostly only manifest when entering the circulation of the bitten individual, and especially when the saliva has been changed in its nature by the excitement of passions, such as great fear, anger, etc. Hence arises the often malignant appearance of bites by infuriated men or animals; while the introduction of such saliva into the stomach would undoubtedly, in most cases, not be attended with serious consequences. This shows the absurdity of the idea that the normal human saliva should be a poison in the mouth of any animal, whether possessing poison bags connected with its teeth or not.

The story reminds us of one which went round the papers some years ago, about a man who was bitten by a rattlesnake through his boot. Long after his death, every one who tried on that boot died of the consequence of a scratch in the foot, produced by a serpent's tooth projecting inside the boot; and the cause of the mischief was only discovered when many persons had been killed. The inventor of this story did not know that the rattlesnake poison is only active when freshly injected from the poison bag.

THE SOURCE OF VOLCANIC ACTION.

Volcanoes have long been considered as having their origin in the liquid interior of the globe. This view is still held by some of our best physicists and geologists, though others hold widely different views. While some believe that the internal heat is the cause of volcanoes, others hold that both heat and volcanic phenomena are due to the motion resulting from lateral pressure transformed into a sufficient degree of heat to produce volcanic action, and the question is receiving no little discussion in scientific circles at the present time. The distribution of volcanoes is confined very largely to the boundaries of continents bordering on oceans or seas, or on islands within these bodies of water. This fact leads to the conclusion that water has something to do with volcanic action. And it has been explained by supposing that, as the subsidence of the oceanic regions necessitates the elevation of the continental regions, the shore lines are subjected to a great strain from being the fulcrum point of leverage. This strain results in fracture which admits the water to the heated parts below, and this, by its sudden expansion, forces up the melted material to the surface. The unequal straining, of the submerged crust in subsidence, would cause fracture which, by admitting water, would account for oceanic volcanoes. Continental volcanoes may be due to the pressure of shrinkage which forces the molten matter through mountain fractures, because they are the places of least resistance.

Whether volcanoes originate in a molten nucleus or stratum beneath the crust, which would naturally be homogeneous throughout, or from isolated molten material like subterranean lakes or reservoirs, is largely demonstrated by a consideration of the material brought to the surface by volcanic energy. If this is uniform in its chemical properties, it would argue a common source; or a variety of sources, if the ejected matter varied in its composition. It is found, by inspecting the material thrown out from different craters or fissures, that it differs widely in composition; and even that the lavas of the same volcano vary at different periods. Phillips, and later Durocher, accounted for this diversity of composition on the supposition that the interior fluid mass separated into different strata, according to the density of its components, and that sometimes matter from one of these was ejected, sometimes from another, and a vein from a mixture of two or more at once. It may also be explained by

supposing that each eruption was the result of local chemical action which melted the rock, and, by thus increasing the pressure, forced it to the surface. Hunt and others explain it on the probable supposition that the originally cooled crust is anhydrous, while the sedimentary deposits are all impregnated with water. When the internal heat invades the position of these, the presence of water would greatly facilitate fusion; and the injected matter would vary in composition according to the composition of the stratified deposit which was subjected to the degree of heat requisite for fusion. This Hunt, Babbage, and others consider a "ready explanation of all the phenomena of volcanoes and igneous rocks."

On the other hand, Robert Mallet concludes "that the crushing of the earth's solid crust affords a supply of energy sufficient to account for terrestrial volcanicity," and has calculated that the crushing of 7,200 cubic miles of rock would cause heat enough to make all the volcanic mountains of the globe. These views have been vigorously opposed by Professor Hilgard, of the Michigan University, and Rev. O. Fisher, of England. They claim that Mallet's experiments of crushing 1½ inch cubes of rock, and producing a heat of 217° Fah., are not sufficient to prove that the crushing of solid rock could produce fusion. Hilgard claims that the friction of the crushed and powdered particles would be necessary in addition, and implies that the resistance of the rock would be "materially diminished by the downward increase of hypogeal temperature." Mr. Fisher claims that, if crushing rock will produce fusion, the cubes Mallet crushed in the air should have been fused. He also objects that a horizontal prism of rock, ten miles long and one in sectional area, if crushed, would have the heat uniformly distributed, and nowhere sufficient to cause fusion; and asks, if it fuses in certain parts, what determines the localization?

Mallet meets these objections by saying, first, that the pressure on rock 10 or 20 miles below the surface would be 2½ or 4½ times greater than at the surface. This would necessitate greater "work" to crush it, and hence cause greater heat. This, added to the 1,000° or 2,000° of heat 10 or 20 miles deep, would be sufficient, in his estimation, to fuse rock. In his experiments, he subjected the stone cubes to pressure on only two opposite sides, leaving the other four sides free; and if the six sides had all been pressed simultaneously, it would have required much greater force and produced much more heat. Again, in his experiments, the crushing force was so slow, comparatively, that much of the heat was carried off by the steel plates during the process. But in the earth's crust the pressure is on all sides, and the force acts so suddenly that there is little or no time for diffusion of the heat produced. As to the localization, he says, that if the rock be homogeneous, the greatest force of pressure would be exerted at the surface which is in contact with some fixed rock, and here the melting would commence. He instances, in proof of this, rocks in the foundations of buildings and masonry, when subjected to too great pressure, which have thus been crushed or "spalled" off, and always at or near the joints. If not homogeneous, the crushing would commence at the weakest place; and in either case the crushing must be localized either at the end or ends of the prism, or at the place of weakness where it first yields. Again the temperature of each succeeding foot of rocks will be raised by the heat imparted from each preceding foot of rock that is crushed. Now since the pressure is 4½ times greater twenty miles down than at the surface, this multiplied by 217° gives 928° of crushing temperature for the first foot, and the following feet would increase correspondingly in temperature.

Mallet illustrates his points by noting the fact that the resistance of air before a moving meteorite is sufficient to make the latter red and even white hot; and the greatest heat occurs in immediate contact with the moving body, where the air is subjected to the greatest pressure. Also in cutting a cast steel file in two by the rapid rotation of a soft sheet iron disk in contact with it, the greatest heat is developed at the working point, and here the file is softened and cut in two by means of the heat remaining in it, while the air carries off the heat from the disk in its revolutions. Cutting of railroad bars by a similar process is another illustration in point. The exaltation of temperature by the work of modifying the form of a body is also clearly seen on rapidly hammering tough iron, when after a minute or two it becomes red hot, then in a second or two it reaches nearly white heat. Mallet takes into the account the additional heat caused by friction of the crushed particles, as suggested by Professor Hilgard, but says he knows of no experiments that prove its amount, and that it cannot be determined in any other way. The other objections which Professor Hilgard raises, namely, that the increase of heat from the surface toward the center would soften the rocks more and more as their distance from the surface increased, and consequently cause the production of less heat from their displacement by lateral pressure and crushing force, is doubtless a very weighty and important one; but Mallet seems not to have given it an adequate answer.

Professor J. D. Dana, probably the best geologist on this continent, does not accept the conclusions of Mallet, but holds that "igneous eruptions must for the most part have come from great fire seas, and had their origin in the earth's original liquidity." To substantiate this view, he instances the great doleritic ejections of the triassic-jurassic era, which extended from Nova Scotia to South Carolina—a distance of 1,000 miles, and the far greater trachytic eruptions of later eras over the Pacific slope of North America. The matter thrown out from each of these very broad areas, being the same in character throughout, points unmistakably to the conclusion that in each case it must have come from one

great fire sea or the molten interior of the earth. At the time this matter was ejected, it must have come from a common source; but the connection of all its parts may not be retained till the present time, but may have become cut off by subsequent cooling.

THE MEETING OF THE PUBLIC HEALTH ASSOCIATION

A meeting of the American Public Health Association was recently held in Baltimore, Md. Several interesting papers were read. The abstracts below given are selected from the most interesting of the papers read.

VENTILATING BY MACHINERY.

Mr. Carl Pfeiffer said, in substance, that, through the difference of from 30° to 40° between outer and inner air, a sufficient ventilation in an apartment may be obtained in winter, but not in spring, summer, or fall. In these seasons it will be necessary to resort to mechanical means, which the best authorities consider generally to be nearer perfect than any other ventilating system. Mr. Pfeiffer thought that owners of tenement houses should be forced to supply proper ventilating machinery which should be located out of the reach of the tenants.

A NEW ARGUMENT FOR TEETOTALERS.

Dr. Hitchcock suggests a new raid on the liquor dealers, for causes which will add a novel argument to those already urged by total abstinence advocates. The vital statistics of the United States, he says, show a mortality of from 7 to 16 per cent traceable to the use of alcoholic drinks. In New York, \$56 a year for each inhabitant is spent for such beverages, by which life is shortened 28 per cent. Each State should ascertain, by a commission, how much loss it suffers from the traffic in liquor, and should assess that loss on the dealers equitably according to their sales.

THE FINANCIAL EQUIVALENT OF DISEASE.

A remarkable paper on this subject was read by Dr. Benjamin Lee. The object was to determine the loss sustained by the city of Philadelphia in dollars and cents through the epidemic which occurred there in the winter of 1871-2. Dr. Lee calculates the loss by diminution of travel and traffic on the railways, and loss to hotels, to merchants, and to business generally. He also computes the loss due to sickness and diminished production and by death. He sums up his calculations as follows: Expenses incurred in care of sick, \$203,879; loss by sickness (time), \$1,072,063; loss by disability (time and expenses), \$10,000,000; loss by death (based on estimate of value of a life to society), \$5,013,000; burial expenses, \$74,420; total, \$16,363,364. As the epidemic was due to neglect of sanitary precautions and might have been prevented by judicious sanitary legislation, the above represents in cash the money equivalent of the disease, which was wholly lost to the community.

A NEW USE OF NEW YORK GARBAGE.

Mr. Jackson S. Schultz suggested a new use of the garbage of New York. His plan was to buy one or more of the islands in Long Island Sound, erect sheds, and colonize 60,000 hogs, which should be fed with the garbage by the paupers and criminals of the city, under the control of officials wholly independent of political supervision or influence.

THE HORSE DISEASE.

The *anthrax epizootic* was the subject of a valuable paper by Mr. Law of Cornell University.

The most universally acknowledged causes of the malady in animals are: Plethora, or a state of the blood highly charged with organic elements; an impervious soil or subsoil; a very rich surface soil; inundations; a period of heat and dryness calculated to foster the decomposition of organic matters to a great depth in the ground, and great contrast between the day and night temperatures; and in one case all coincided to produce one of the most malignant types of the disease. It may be added that, while this affection is communicable to all animals by inoculation, it can scarcely be said to spread in any other way, and is therefore to be looked upon as essentially an enzootic disease. We must go to such places as the inundated margins and deltas of large rivers, dried-up lakes and marshes, or the rich and pestilential Russian steppes, to find any approximation to the disastrous outbreaks in man and beast which blacken the history of past ages.

It only remains to be noted what was done to check the disorder. One hundred of the best steers were turned on a higher pasture with a gravelly subsoil. The remainder were of necessity left in the higher of the two meadows formerly occupied, but were fenced out from the swamp and lower meadow where the clay approached to the surface. All of both herds were fed with hay and watered with a solution of carbonic acid and bichromate of potassa. The fifty sick bullocks took small doses of nitro-muriatic acid and bichromate of potassa by the mouth, and a solution of sulphate of quinia, iodide of potassium, and bisulphite of soda hypodermically, each repeated twice daily. The result was that of fifty animals seriously ill only two died, and the rest made a prompt and perfect recovery.

F. A. A. says, to amateurs wishing to mark patterns for scroll saw work: Take the bracket or other piece of work which you desire to copy, and spread over it a sheet of paper, securing it from slipping. Rub gently over it a piece of saddler's black leather. All the outlines will be marked accurately, and it takes but a minute to copy any piece. The saving in money for patterns, which cost from 10 to 20 cents in the stores, is therefore considerable, and it is often impossible to get a pattern of some particular thing which strikes your fancy."

WORKING STEEP GRADIENTS BY LOCOMOTIVES.

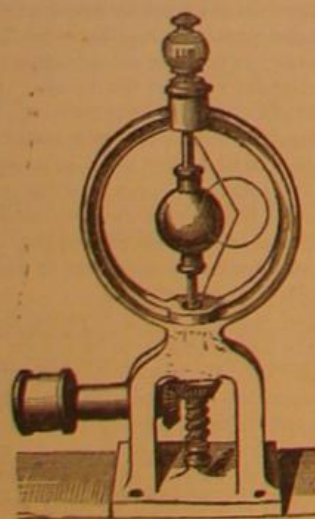
We illustrate herewith a novel system of working trains on steep railway gradients by locomotive engines, patented by Mr. Graham Stevenson, of Airdrie, and Mr. John Reid, of the Provandhall collieries, near Glasgow, Scotland. The apparatus has just been erected at the collieries named.

The incline selected for the first application of this system leads downwards from the main rails of the Caledonian Railway to two pits about three quarters of a mile distant, with an average gradient of about 1 in 13, and ranging between 1 in 11 and 1 in 15. About six years ago Mr. Stevenson's firm constructed two powerful tank locomotive engines to work this incline, the steepest, perhaps, with one exception, worked by locomotive power in the kingdom. The traffic from the pits has so increased of late as to make it impossible for the engines to overtake it, and the construction of a third engine, or some other means of assisting the two, came to be a matter for consideration. With the latter view it was proposed to erect a small stationary engine, working a wire rope; but in place of a stationary engine, the idea of stationary gearing, which might be acted on by one of the locomotive engines, occurred to the patentees, and this idea has been put into practical operation. Since that time the machinery has been inspected at work by a large number of engineers and and colliery proprietors, many of whom have expressed decidedly favorable opinions regarding it.

Our engraving is a side elevation, showing a locomotive in the position for actuating the winding gearing. The winding drum and its gearing are mounted in suitable bearings on framing fixed in a stone-cased excavation below the line of rails on which the locomotive is brought to the spot. The shaft of the winding drum has fast on it a spur wheel, in gear with a pinion on an intermediate shaft, which has also fast on it a pinion in gear with one of a pair of shafts. These shafts have wheels fixed on them, with their uppermost parts at the level of the rails, and with cranks on them connected by rods. The rails are cut away at the parts where the tops of the wheels are; and when the locomotive, having two pairs of coupled wheels, is run into position up against a buffer bar, and secured there by a screw, its four wheels rest on the four wheels below, the entire weight of the locomotive serving to impart driving power by adhesion. Then on the locomotive being made to drive its own wheels, these, acting frictionally on the wheels below, drive the winding gearing. The rails form part of a siding, while the winding drum is on the line of the incline. When the train is brought to the top, the locomotive is freed from its anchorage, runs out, and engages the trains on the level, disposing of it as desired. In lowering the empty trucks down the incline, the pinion is disengaged, and the drum controlled by the friction strap and lever. The amount of work capable of being performed with the new arrangement is four times greater than before, when the delays consequent on running the locomotives up and down the incline, shunting, coupling, sanding, etc., are taken into account, the cost of labor remaining the same, while the wear and tear of the rails and engines is very greatly diminished.

MEIN'S PATENT GOVERNOR.

This governor depends for its action on the same principle that operates if we pass a cord through a bullet and cause the



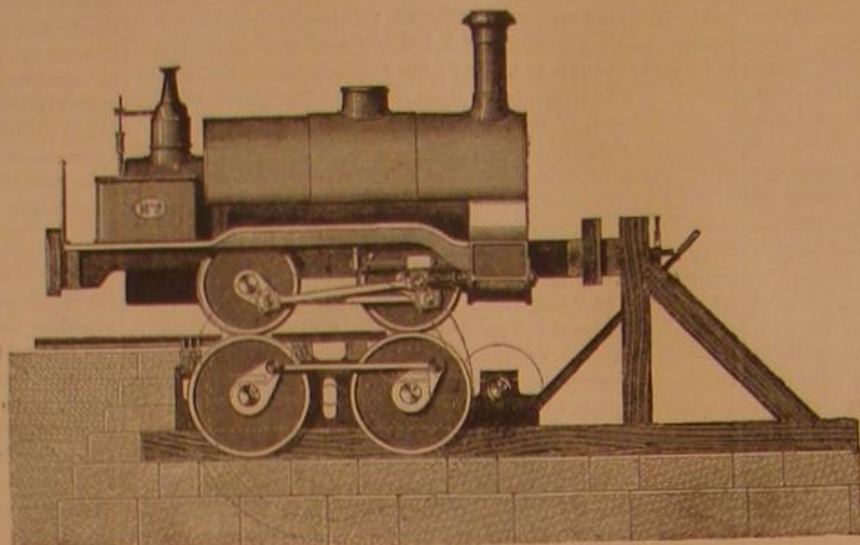
bullet to revolve in a plane; the cord being held at each end, these ends will be pulled toward each other. A heavy ball is made up of two half balls united by a horizontal central pin; each half ball is fixed to a rod; the top rod terminates in a ball carried in a socket in the top of the frame just under the lubricator; the bottom rod ends in a plain jaw, which takes hold of a rod guided in the frame, and fitted with a miter wheel sliding on a feather as shown; on this rod is a collar and spiral spring to aid gravity; the fork to the throttle lever takes into the collar at the bottom. If the ball were perfectly symmetrical when it was caused to revolve on its axis, it would not diverge in any way; but the center of gravity not coinciding with that of rotation, the ball diverges and tends to assume the position shown in the dotted lines, the halves of the split ball turning on each other.

This is a very simple governor, neat in appearance, cheap, and sensitive. It has been fitted in some important mills, and is, we have reason to believe, giving much satisfaction.

Swedenborg as a Chemist.

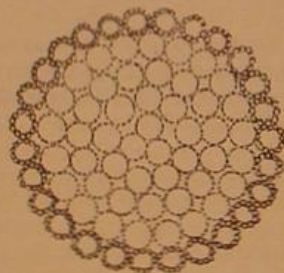
According to the views held by Swedenborg, the particle of water is built up in this way: The natural point constitutes the beginning of all things, in the same way that the geometrical point constitutes the beginning of geometry, and is

thus a medium between the infinite and the finite. The natural point is described as being produced immediately from the infinite, its exact nature being scarcely conceivable; it consists, however, of pure and total motion, and analogy might lead one to compare it with a spiral force. Unfortunately for this theory, it happens that in all arguments as to the origin of matter it is precisely this medium between the infinite and the finite, this natural point, which constitutes the point in dispute. We do not see that its comparison to a spiral force gets over the difficulty. The next steps also depend entirely on the imagination. One point is held in equilibrium by another, and hence we have a species of concrete motion, or a motion which is local and gyratory, and thus distinguished from the all-prevailing motion of the



WORKING STEEP GRADIENTS BY LOCOMOTIVES.

infinite; at least, this is the way we understand the author. This complex motion is termed an active finite, and its complexity is increased by a second process of development, whereby the first active finites are held in mutual equilibrium, and a second finite is produced, and so on up to the fifth. In Swedenborg's view the particle of water is reduced to a further development, wherein the sixth step is reached, and its character may be illustrated by the annexed diagram.



of heat, shown in the second engraving. In the deepest parts of the sea, where the solar heat does not penetrate, this perfectly fluid position of the particles cannot be maintained, and they accordingly assume a fixed quadrilateral pyramidal position, easily imagined by bringing into close contact four of the above circles, and imposing another circle on the center to cover the space intervening.

The particles of water being thus arranged, an increase in pressure results in the breaking up of some of the aqueous particles, of which the component parts go to fill up the cavities and spaces of the remaining, intact, particles of water. According to Swedenborg, this disintegration or decomposition gives rise to the salts and metals, and the character of the new substances produced depends on the shape of the interstices. Thus, for instance, salt owes its acidity to the spiculae which surround a body formed by the juxtaposition of spheres. The shape of the particle of common salt, according to this theory, consists of one cube and several triangles: to be in perfection, it ought to consist of one cubical body with eight triangles or points, as shown in the third engraving.

Variety in the characters of salts is produced by the breaking off of one or more of these points, so that the less number of spiculae will give rise to a salt possessing less acidity, because there is a similar number of spiculae to produce acidity. The spiculae of these bodies are consequently the acids, and the body without any points would be without taste or acidity, and would constitute some kind of earth. When heat is applied to a salt, an acid is supposed to be produced by the volatilization of the points, while the stoma remains behind and forms the earth. The author does not explain why the points are volatile, and not the body, which we should expect to be equally so, seeing that it is supposed to have been produced contemporaneously with the points by the disintegration of like particles of water.

The different kinds of acids are held to be produced by the conjunction in various matters of one or more of the acid spiculae, which is the simplest or first kind of acid. Niter is supposed to consist of a central volume or subtle fiery matter around which are disposed the acid particles. Swedenborg's theories of oil, sal ammoniac, and lead are developed by a like method of reasoning without facts, and with a full flow

of imagination, but we think the example we have given will afford a sufficient illustration of the author's views.—*Chemist and Druggist.*

American Leather Belting Abroad.

Our English contemporaries are very unhappy over the introduction of American products into their country. Almost every trade journal that comes to us from abroad has something to say about our encroachments upon their manufacturing interests. The last *British Trade Journal* says

"It is certain that the Americans are actively bestirring themselves at the present time, with a view to getting certain of their manufactures into the British market. Their iron and hardwares have already got a footing—and in the latter case a by no means despicable one—here; their cotton manufacturers have made the first sign of advance towards a region hitherto dominated by Manchester; and it would seem that the leather trade is now to feel the influence of American competition. It will interest Birmingham and Walsall to know that the first invoice of leather belting has recently been shipped by a New York firm, who, we are told, work up in their Brooklyn manufactory ten thousand hides per annum. The order for the shipment referred to was placed by our great gun manufacturer, Sir William Armstrong, and included two belts of unusual dimensions, one being 2 feet 8 inches wide and 94 feet long, and the other 18 inches wide and 123 feet long, and of double thickness. Leather belting is largely manufactured, as is well known in the centers of the trade, in this country, and as regards material and workmanship could scarcely be surpassed. We can only suppose, therefore, that an English firm was led to place an order for such goods in America by some advantage on the

score of price. The American manufacturers deserve all credit for the enterprise and energy they are showing in their efforts to compete with British makers in their own market. What possible chance could they have of doing so successfully, we ask, if their goods were saddled with such import duties as British manufactures have to bear before they can reach the American consumer?"

MOORE'S PULLEY BLOCK.

We annex an illustration of Moore's 7½ ton pulley blocks, with which two men can lift a load of 8 tons. It represents a front view of the apparatus showing the internal gearing, which is of 20 inches outside diameter. In these blocks two



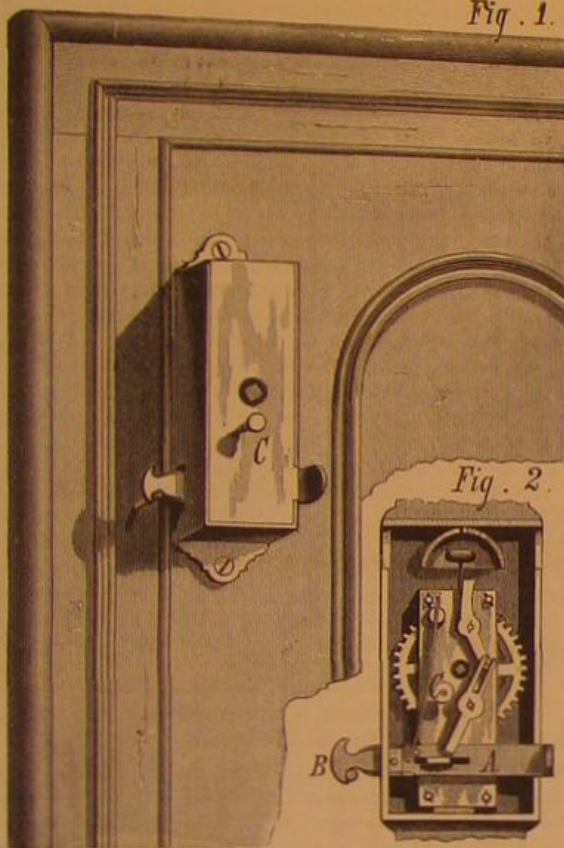
revolving disks are mounted face to face upon a shaft. The meeting face of each disk is dished out, and the periphery of each dished recess is formed into an internal toothed wheel. One disk has a tooth less in number than the other, but both have the same pitch diameter. When the disks are mounted on the shaft, the space formed by the meeting of the two recesses is occupied by a pinion of smaller pitch diameter than that of the internal disk wheels. This pinion is mounted loose upon an eccentric forged in one with the shaft passing through the disks, and is carried round by the revolution of the shaft and eccentric. In revolving, the pinion rolls round the periphery of the internal wheels, and in one complete orbit the faces of the two disks move a distance equal to the pitch of one of the disk teeth, owing to the gradual displacement of the odd tooth. A chain wheel is cast on the back of each disk, and from the cross head and hook to which the weight to be lifted is attached two chains pass, one to the right side and one to the left side of either disk chain wheel. The loose ends pass over and are connected at a convenient distance below the

block, forming a loop, which rises as the weight is lowered, and *vice versa*. The eccentric shaft is made to revolve by a hand chain wheel keyed to it, the wheel being worked by an endless hand chain, and the machine is supported in a frame with a suspending hook at the top, to attach to a beam or other means of support. The differential power is obtained by the gradual displacement of the odd tooth in the revolution of the pinion. The disks are perfectly free to move either way round in the frame, but the weight, coming half on the right side and half on the left, perfectly balances the block and keeps the lifting chain plumb and fair. One advantage of this system, among many which it possesses is that the weight cannot run down when left suspended.

POWELL'S IMPROVED BURGLAR ALARM.

In the accompanying engraving is represented a new and simple burglar alarm, which may easily be attached to any door. It is so constructed as to be rendered operative or inoperative at will, and is located on the door, shutter, or window, so that a wire inserted from the outside cannot be used as a means of discovering its presence. It presents a neat exterior appearance, as shown in Fig. 1. The rotary parts are exhibited in Fig. 2.

The device consists of a metal box in which is inserted an ordinary clock train, provided with spring, etc., and having the arm, to which the pendulum is usually attached, extending upward and carrying a hammer for striking a gong. Across the frame is a sliding bar, A, the movement of which is limited by a projection passing through a slot made in the direction of its length. This bar, by means of a spring, has a tendency to move inwards or to the right, as placed in the engraving. Connected with the bar is the lower arm of a lever, the upper forked arm of which is adapted to a pin on the arm of another lever. The lever last mentioned comes in contact with the hammer arm, and prevents its vibration when the bar, A, is in the position shown in the engravings. To the end of the bar, A, is attached a catch, B, which hooks over a pin fixed on the door frame when the apparatus is set. On the door being opened, this catch is moved from the pin; and the bar, A, being carried back by the spring, the hammer arm becomes free, and the clockwork causes the bell to sound the alarm.

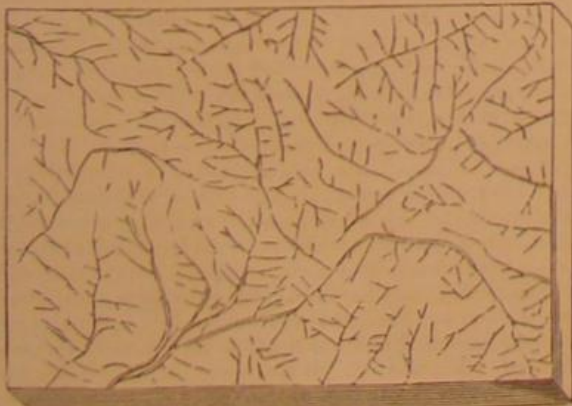


When it is desired to hold the alarm out of action, a pin, C, is pushed inward so as to prevent the movement of the escapement arm.

Patented May 18, 1875. For further information, relative to sale of State rights, etc., address the inventor, Mr. Thomas Powell, No. 802 Chesnut street, Philadelphia, Pa.

THE EMISSION OF CARBONIC ACID FROM ROOTS.

It is generally known that leaves decompose carbonic acid when they are exposed to the action of the sun, and disengage carbonic acid when kept in the shade. This is easily proved by simple apparatus, but it is not so readily shown that carbonic acid is emitted from the roots. An interesting experiment, which evidences the latter fact, may be made by means of a slab of polished marble placed a few inches beneath the soil and covered with fine sand. Beans are planted in the sand, in which they will grow well for several weeks. When the plants begin to wither they are pulled up, and the



marble plate removed. The surface of the latter over which the roots have run will be found covered with fine grooves, as shown in the engraving, which indicate the course of the roots. Marble is entirely insoluble in pure water; but like all varieties of carbonate of lime, it is soluble in water charged with carbonic acid, so that the grooves show that the roots must have emitted carbonic acid, which thus acted upon the stone.

THE HOLBROOK PATENT BLIND HINGE.

We illustrate herewith a novel blind hinge, which is so constructed that by simple mechanism, outside blinds may be closed and opened from the inside, and may be held in any desired position, and all without raising the window. The

Fig. 1.



device also effectually prevents the blinds' slamming during strong winds, and is well suited for either heavy or light shutters. It will be found without doubt a convenience of importance during the approaching winter, since it admits of greater ease in operating the blinds, and at the same time obviates the necessity of any part of the person being exposed to the cold air.

The apparatus is shown attached to the lower part of the blind in Fig. 1, and in detail in Fig. 2. Referring to the latter figure, C is a rod which extends through the window casing and terminates outside in the pinion, D. This pinion en-

Fig. 2.



gages with the crown wheel, E, Fig. 1, which is operated thereby. The rod, C, is turned inside the house by the crank, A, which has a joint motion, and carries a lug on its under side which meshes in the serrated edge of the fixed rosette, B. It will readily be understood that turning rod, C, through the gearing, moves the blind on its hinges; and as the rod, by the means already described, can be held firmly in any position, of course the blind is at the same time secured. The device is durably constructed, and not likely to get out of order. For further information, address the Holbrook Blind Hinge Manufacturing Company, Watertown, N. Y.

MEIGS' IMPROVED DIOPTRIC LIGHT.

The annexed illustration represents a dioptric light, invented and patented by Brevet Major-General M. C. Meigs, Quartermaster General, U.S.A. It consists of a spherical



lens and adjustable bracket. The lens is hollow and is filled with filtered water or a solution of salts; its diameter, for general purposes, is about six inches. The bracket consists of an ordinary ground burner and socket, the latter joined to the adjustable or swinging arm. The lens is supported at three points, namely, by the lower or stationary half of the swinging arm and by two small supports projecting from the upper part of the socket.

This dioptric light is so simple in its construction that the illustration is about all that is needed to explain it, and this

simplicity is an addition to its value as a useful invention. It can be handled by any one without instruction, and there is nothing complicated or intricate in its workings, to increase its liability to getting out of repair.

One such lens, possessing the capacity for adjustment of this apparatus, if placed upon a bracket or candelabrum on the side wall of a room or on the gallery rail of a church or hall, could readily be adjusted to cast its beam of light upon the reading desk of the preacher or lecturer, and thus enable him to dispense with lights about the desk on chandeliers above or in front of him, which are so fatiguing to the eyes of the audience. The lens condenses the light directly upon the object; and several such lights and lenses may be mounted upon brackets or chandeliers, and so adjusted as to concentrate their rays upon any book, map, picture, diagram, or piece of apparatus which it may be desired to strongly illuminate.

Messrs. Baker, Arnold & Co., and Cornelius & Sons, of Philadelphia, are General Meigs' principal agents for the sale of the dioptric light.

PEDDEN'S IMPROVED COW TAIL HOLDER.

In the annexed engravings is represented a handy little device, designed for the convenience of farmers and dairymen. Its object is to prevent the cow switching her tail during the operation of milking, thus rendering the process of milking less fatiguing in the fly season, and the likelihood of spilling the milk less frequent. Dairymen, we believe, avoid this trouble, in a measure, by fastening the tail to one hind leg by a bit of string; but this is a rather primitive and certainly unhandy device, for which the present invention will serve as a substitute.

Fig. 1.



The attachment, which is represented plainly in Fig. 2, consists of a short bar of metal, on each end of which is cast one of the stationary jaws which, with movable jaws pivoted at the ends of their shanks to said bar, form, when closed together, rings, A and B, of different sizes. The jaws are held together and the rings thus closed by collars, C, which are forced outward by the spiral spring, encircling the bar. To use the device, the smaller ring, A, is opened and sprung around the cow's tail just above the switch; the larger ring is similarly attached to the gambrel of the leg, the whole being disposed as indicated in Fig. 1. It will be seen that the invention holds the tail firmly, while it can very easily be slipped on or off. The inventor assures us that it occasions no annoyance to the cow.

Patent now pending. For further information regarding sale of invention or of rights, address the inventor, Mr. Thomas Pedden, Middletown, Conn.

The Brayton Oil Engine.

The Brayton gas engine, a motor driven by the combustion of ordinary street gas mingled with air, and now quite well known to engineers, has been made the basis of another invention of somewhat similar nature, in which the motive power is furnished by burning a mixture of crude petroleum vapor and air. The oil engine, as far as we have been able to learn, and judging from our own brief inspection of its workings, bids fair to be a successful machine, and one of considerable utility to those who require light power but who wish to avoid the inconveniences of steam. The engine which we saw in operation was alleged to be of 5 horse power, and served to run a variety of metal-working machine tools.

The expense of its working, we were told, was only the cost of five gallons of crude petroleum per day, averaging some forty cents. At a future time we hope to go into the construction of the apparatus more fully; our limited space enables us to give but brief notice this week. A small pump lifts the petroleum directly from the barrel to the cylinder. An air pump compresses air into a reservoir at the lower part of the machine. The air current passes to the cylinder, and in suitable proportion mingles with the oil, which is introduced in the form of spray. The mixture, by a small flame which is constantly maintained, becomes ignited, expands, and so acts upon the piston.

Correspondence.

The Electric Light and Heat.

To the Editor of the Scientific American:

There is perhaps no more curious phenomenon in electricity than the heating of the conductor by the electric force. The fluid theory clearly falls far short of a reasonable hypothesis, for the reason that the so-called electric fluid must be imponderable, and the imponderable is capable neither of combustion, nor of friction, nor of chemical action, nor of affecting ponderability or matter, some one of which functions is requisite to any production of heat, simply because an imponderable is nothing at all—imponderability having no existence. The theories of Ampère, De la Rive, and others practically resolve the electric force into an imponderable something, separate from and which affects the atomic particles of matter, and its propagation into an interchangeability of the polarities of the imponderability upon the faces of atomic particles.

Ten cups of a Grove or carbon battery will instantly heat a fine platinum wire to redness, and instantly melt a lead wire of the same fineness. Nearly twenty cups will be required to raise an iron wire of the same fineness in the same time to the same degree of heat; about eighty cups, a gold wire; in the neighborhood of one hundred cups, a copper wire; and almost one hundred and twenty cups, a silver wire: the capacity of the several metals to propagate the electric force being about as follows, the comparison being with platinum indicated as a unit: Platinum, 1; lead, 1.1; iron, 1.5; gold, 8; copper, 11.5; silver, 12.

It will thus be understood that, as silver is about twelve times as good a conductor as platinum, it requires about twelve times as much battery force to raise it to a given temperature as it does to raise platinum to that temperature.

Assuming that we are in an experimenting room, observing the heating of a platinum wire by the electric force, we comprehend two facts: First, that the heat we witness is not by combustion; second, that there is no chemical action in the wire. These are really important acquisitions of fact, for we are at once brought to the positive conclusion that, as the heat is produced neither by combustion of the wire, nor by chemical action in the wire, it must inevitably be due to friction. To friction of what? Not of "interchanging imponderabilities," or nothings, which can neither themselves exert friction, nor influence matter so as to cause matter to exert friction; but of the motion of one atomic particle of matter with relation to another.

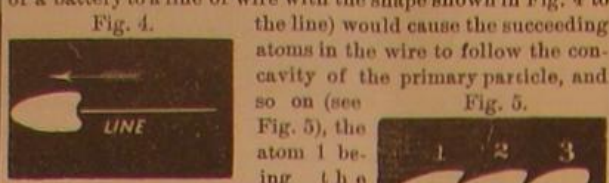
Except very indefinitely, no idea has yet been formulated of the action of a galvanic battery. Perhaps we may determine what that action is, taking as our basis the elements of zinc and a corrosive fluid, which in reality form the battery. It is a mistaken notion that the copper plate is an element of the battery. It in reality serves the same purpose in connecting a wire with the battery that the ground plate sunk into the earth at a telegraph station serves in giving a connection of the line with the earth. It is only necessary that this battery plate shall offer greater resistance to the action of the corrosive fluid than the zinc; and the greater the comparative resistance it offers the greater will be the positive force of the battery; for when the connecting plate is itself attacked by the fluid, it generates a counter electric force in the battery; and if it should be as readily attacked as the zinc, the generated forces would entirely neutralize each other. The copper plate is technically termed the positive or + pole or electrode, and it is in reality the positive electrode, when we consider that the action of the zinc and fluid is to set up repulsive vibration in the direction of the fluid and copper. Taking an atomic particle as naturally a sphere, what do we understand to be its alteration by repulsion?

In Fig. 1 the atom is represented as having four cardinal points. Supposing this impact, or repulsion, to be exerted from the zinc electrode at E, the atom being understood as an atom of the corrosive fluid, the sphere would be flattened at that point, and the result, owing to the tenuity of the

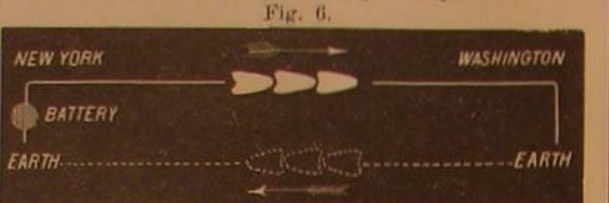
atom, would be a sort of ellipsoid (see Fig. 2). That is to say, the impact at E would force the interior of the atom in the direction of W. It is obvious that the shape given the atom would be transferred to the next, and so on indefinitely, as also, owing to the cohesion of particles, to those parallel with it (see Fig. 3). So that the shape of the atom at E would be propagated to an indefinite distance, losing force, however, in each successive propagation. I need not point out the fact that such a shaping of the atoms would account for the longitudinal elongation and transverse contraction of a bar of metal through which the electric force is propagated.

What would be the chemical result of such a shaping? The nature of a compound is such that a certain atomic condition is necessary to its becoming or remaining a compound. The change in that condition would of necessity result in decomposition or separation of the elements of the compound, as no two elements of a compound sphere would be capable of assuming precisely the same form, and hence the force of compound atomic cohesion would be nullified. There must be a different action of the atomic particles of matter, in order to produce the observed phenomena, from a mere circular or rotary movement, and something different from a closed circuit around the particles, or an interchanging of

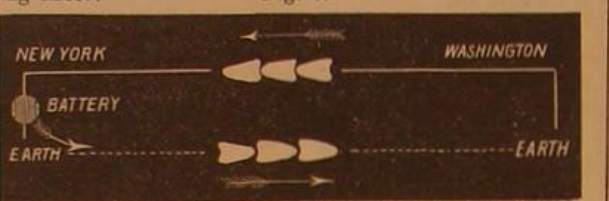
polarities of an extraneous imponderability. There must be a shaping of the atomic particles; and reasoning from analogy and the phenomena of repulsion and attraction, we must find in that shaping an approach both to concavity and convexity, concavity at that side of the molecule where the force of repulsion is exerted, and convexity on the opposite side. The concave point is therefore the point of attraction, as the cohesion of particles (supposing that we start from the — pole of a battery to a line of wire with the shape shown in Fig. 4 to



the line) would cause the succeeding atoms in the wire to follow the concavity of the primary particle, and so on (see Fig. 5), the atom 1 being the primary atom, and 2 and 3 being the atoms in the line wire. Thus, what is repulsion from one pole of the battery to the wire is attraction from the other pole of the battery to the wire, the action always being from that pole of the battery which is put to the line; otherwise we should have in a line, say between New York and Washington, the following result, if we put at New York the repulsive pole to the wire.



In this case the electric force, necessarily starting from the battery by repulsion, would appear at Washington a certain space of time after leaving New York. And if we should put the opposite pole to the line, we would have the following effect:

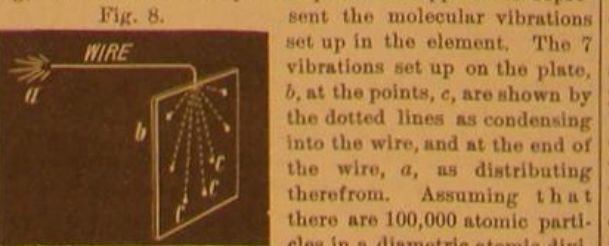


In this case the force would be manifested at Washington by means of the earth connection before appearing at the concavity pole of the battery which is put to the line. All this is assuming that the force is propagated solely by a forward motion or vibration—repulsion.

The clearest way of looking at the question is through the ordinary phenomena of push and traction. A person pushing a bar of metal forward with a certain force is exerting repulsion upon whatever is attached to the other end of the bar; if he draw the bar toward him, he is exerting the force of attraction or traction; in either case a period of time is occupied by the passage or propagation of the force from the person to the other end of the bar; in either case he is really exerting the forces both of repulsion and attraction. He is therefore imparting to the atoms of the bar a polarity positive and negative, so to speak, convex toward himself when he pulls, and concave toward himself when he pushes.

Returning to the galvanic battery, we find that there is a certain surface of zinc subjected to the action of the liquid. A certain number of molecular changes will be set up by this action. The changes must therefore be in the form of a vibration, taking for example a single atom of the metallic elements. The relation between the elements will result in an aggregation of force, which will convert the spherical atom into an ellipsoidal shape, which, immediately after its conversion, will return, or partially return, to its spherical shape. Then another aggregation of energy takes place in the elements, and the atom is again converted into a sort of ellipsoid, and again it becomes a sphere. These successive changes amount practically to a vibration of the atom, spherical to ellipsoidal and return, and spherical to ellipsoidal and return. If this accumulation and conversion were sluggish, there would not be a sufficiently rapid vibration to cause destruction of the force of affinity or cohesion, by which a compound is held a compound, and secure separation of the elements of the compound; but the vibrations of the atoms are so rapid that the force of cohesion, which is neutralized or disrupted by each vibration, is not sufficiently quick in action to restore the condition necessary to preservation of the compound in the time intervening between the electric vibrations; and as a result, the elements are separated, the compound is decomposed. This, I am convinced, is the phenomenon of electrolysis, though I have not space at present to elucidate all the features of the proposition.

It will from the foregoing be understood that a certain surface of elements will evolve so many molecular vibrations per second in the circuit of the elements, and that, however large the surface of the elements may be, these vibrations will be condensed into the connecting conductor. Perhaps this will be clearly comprehended from the following engraving, in which the dots upon the plate are supposed to represent the molecular vibrations set up in the element. The 7 vibrations set up on the plate, b, at the points, c, are shown by the dotted lines as condensing into the wire, and at the end of the wire, a, as distributing therefrom. Assuming that there are 100,000 atomic particles in a diametric atomic divi-



sion of a No. 20 wire, and that the number of vibrations generated upon the surfaces of the elements of a single cell of battery is 10,000,000 per second: there will, theoretically, either be 100 vibrations per second of each atomic particle of the wire represented in force as 100,000, or 10,000,000 vibrations of each atomic particle represented in force as 1, which latter is doubtless the more correct assumption. Now as we increase the number of cups to 100, we obtain either 1,000,000,000 vibrations per second, or 10,000 vibrations of each atomic particle per second, or we obtain 100 times the force of vibration of each atomic particle. Supposing that we place in this wire a section of finer wire, in which there are but 100 atomic particles in a diametric division, it is obvious that the spheroidal vibrations of each atomic particle in this finer wire will be either 10,000,000 per second, or that the force of vibration will be increased 1,000 times. Though I have given no adequate idea of the vibrations generated by such a battery surface in a second, or of the number of molecules of matter in the atomic diametric division of a given wire, is it wonderful—is it not rather a simple and forcible comprehension—that this vast number of vibrations of the atomic particles per second, this inconceivably rapid impact or friction of one atom of matter upon another, should develop the intense heat we observe in electricity, or the violent detonations and disruptions of the metallic conductor? This is the only explanation of the electric heat, and we now perceive why it is that this intensest of heats may be produced without combustion.

I have said that I have given no idea of the rapidity of the electric vibrations. The electric force, when undisturbed by a counter force or an electric force of opposing polarity, has a speed of transmission half as great again as the velocity of light, or 288,000 miles per second. It produces not only the most intense heat, but the most intense light; and we have learned that to yield a deep red, the color of lowest pitch, it is necessary that the propagative atom of matter shall vibrate at the rate of 400,000,000,000 times a second. The color of highest pitch is deep violet, and the frequency of vibrations necessary to produce this color is 760,000,000,000,000 per second. The electric vibrations, the vibrations of the atomic particles of the conducting wire, which produce the red light, cannot therefore be less in number than the vibrations which are the requisite of the light. We stand amazed in the presence of such a mystery of motion, when each atom in the seemingly silent wire before us is endowed with life, pulsating at the rate of over 400,000,000,000,000 times a second.

I would not have it understood that I offer the exact form of vibration of the atomic particles, indicated in the engravings, as the absolutely settled actual form. Further research may modify the form somewhat; but we can accept it as a determined fact that it is a motion or vibration of the atomic particles in a conductor, themselves, and not an extraneous thing influencing the atoms, that yields the phenomena of the electric heat and light.

W. E. SAWYER.

New York city.

Skinning a Rhinoceros.

To the Editor of the Scientific American:

On October 14 last, the rhinoceros and cage belonging to Adam Forepaugh's menagerie, while crossing a bridge about 10 miles from Schenectady, N. Y., suddenly broke through, falling about 12 feet upon a hard bottom beneath. The weight of the animal was 4,200 lbs. and of the cage about 4,000 more, making a total weight of over 8 tons, which proved too much for the structure, which under ordinary circumstances was of sufficient strength. The cage had been drawn through the country by six pairs of large horses; and at the time of the accident, it had gone about half-way across, when the bridge gave way in the center and went down with a crash. The hind wheels going down first, the cage struck with great violence on the rear end.

The driver and horses escaped, strange to say, without accident. The animal struck with great force on his rump, demolishing the end of the cage. By great efforts the cage was extricated by ropes and pulleys from its unfortunate position, when it was found that its inhabitant was much the worse for the fall, having broken his back. He was taken a few miles from the place of the accident, and removed from the cage to a shed near the public road, where he lived a few days and died from the effects of his injuries. He was comparatively a young animal (about six years old), and had not at the time of the accident attained full growth. He was valued at about \$8,000 previous to the accident. Parties interested in the New York State Museum of Natural History, at Albany, N. Y., at once set to work to secure the remains of the late rhinoceros for their already valuable museum; and after great effort they succeeded.

Those who have made natural history or dermatology a study are probably aware that the skin of a rhinoceros has an interesting feature which none but a close observer would detect. About the forelegs and partly on the sides of the animal are seen innumerable cracks or fissures in the skin, some of them nearly half an inch deep, running in every direction without any apparent regard to regularity; but upon closer inspection, the skin is found to be formed like a piece of mosaic work, laid out in pentagons. This peculiar feature of the skin is also noticed in some of the other animals, as the armadillo and a few others, and is best seen in the young animals. As they grow old, these lines of demarcation become obliterated. In the animal under consideration, they were shown very visibly. His teeth were all perfect and bones fully ossified; and upon the whole he was considered by a competent judge to be a great prize. Sixty hours after his demise, active operations were begun to divest the animal of that portion of his body which could not possibly be of any

further service to him, to wit, his skin. The operation was skillfully planned by Professor Ward of Rochester, N. Y. assisted by Professor Lintner, the entomologist, Professor Hall the geologist, of the State Museum, and the writer of this article. Professor Ward who had done similar operations for elephants, hippopotamuses, whales, etc., converted this apparently formidable undertaking into a comparatively simple one. The rhinoceros carcass was first turned over squarely on its back, and maintained in that position by pieces of timber placed on either side. A longitudinal incision was then made, beginning at the lower lip and extending back to the tail. Then there were transverse incisions made, running up the inside of the leg. The skin was then pulled off, working downwards on both sides. The legs were disarticulated at the lower joints, leaving the feet on with the skin. The skin in some places where we made our incisions was fully an inch thick, and very tough, like cartilage. The greatest difficulty was experienced about the head. To peel off the thick clumsy skin from the head, without cutting it, proved rather tedious, especially so about the base of the horn. The horn is not attached, as might be supposed, to the bone beneath by an osseous union, but is merely a protuberance from the skin. Directly underneath it is a plate of bone, supported by elastic tissue, which yields like rubber when the animal strikes with his horn: otherwise he might render himself *hors du combat* by the concussion of the blow intended for his victim. This protuberance, though called horn, is found, when examined microscopically, to be made up of a mass of hairs, agglutinated and conglomerated, thrown out from a thick black basic membrane, from which the horn grows.

Six hours' hard work sufficed to complete our undertaking. The estimated weight of the skin was 300 lbs. It was at once boxed and shipped to Rochester, N. Y. with all despatch, where it is to be tanned and prepared for mounting or stuffing. Several months will elapse before this process will be completed. The reason of the great haste in getting the skin up to Rochester was that signs of decomposition in the structure of the skin had already made their appearance, though the viscera had not yet lost their natural heat. I have since examined at my leisure some of the blood of the animal, with the microscope, with particular reference to the size and shape of the blood globules. I find that they are not any larger than those of the human species; but as to their shape, I am not quite sure whether they are pentagonal or globular. I certainly have noticed among them well marked pentagons, while others were either globular or amorphous. Perhaps this variation in their appearance may be due to putrefactive changes, already in operation in the substance and structure of the blood globule. The flesh was removed from the bones, which were unjointed and also shipped to Rochester. It will require necessarily more time to prepare the bones than the skin. Probably a year will elapse before they are ready for the museum.

Schenectady, N. Y.

M. G. PLANCK.

The Protection of Woodwork, etc.

For the benefit of those who are concerned in wooden erections and preservation of timber, we here condense from the *Building News* some useful notes upon the subject. The woodwork we most require to protect is that exposed to alternation of dryness and moisture, such as our external architectural woodwork is. One of the safest remedies is to fill up all cracks with white lead ground in oil, or oil putty, before pointing. A sprinkling of fine sand over the paint while in a wet state has been used sometimes with capital effect, and we have had large boards, wooden cupolas, and wooden casements treated in this way. The sand renders the paint more durable. A paint made of subsulphate of iron, ground up with any oil and thinned with coal tar oil and a little pitch, is recommended. Coal tar and vegetable tar, obtained from pine timber, mixed with dry chalk, is also a good protective. Linseed oil and tar, in equal parts, boiled together and used while hot, after being scorched over by wood burnt under it, strikes into the wood, closes the pores, and makes an impermeable covering. For fences and rough wood, coal tar sanded over is recommended.

To prevent rot, nothing is better than a thorough seasoning, with proper ventilation. Charring timber, or creosoting it, will do much to arrest decay; but when once the dry rot is found, a cure becomes necessary if we cannot remove or replace with new. A pure solution of corrosive sublimate in water, in the proportion of an ounce to a gallon, used hot, is an effective remedy. A solution of sulphate of copper, $\frac{1}{2}$ lb. to a gallon of water, laid on hot, is recommended as another cure. Paraffin oil, or the cheapest naphtha oil, will stay the decay.

As preventives against marine attacks, coal tar, applied alone, or after a saturation of corrosive sublimate, has been effective in checking worms; also a mixture of lime, sulphur, and colocynth with pitch. To prevent worms in timber, an infusion of quassia is found to be an antidote, anything bitter being antagonistic to animal life. Creosoting is one of the best preventives, however, where it can be used. For articles of furniture a good coating with copal varnish. Linseed oil is a method we can safely recommend. Even for external woodwork of ornamental kind, as gable boards and carved work, if the wood is properly seasoned, it is to be preferred to painting. Other insects, such as ants, infest woodwork in new houses. In larders and pantries they are particularly troublesome, frequently getting into preserves, under the crust of pastry, and into anything of a sweet taste. We may here specify a few of the remedies for this kind of pest: Corrosive sublimate, all essential oils, Bethell's process, powdered borax, petroleum oil, camphor, and creosote.

The objection to the first cure is that it is a poison; but the other materials are almost as effectual, and can be easily applied. Sometimes, however, it is not desirable to wash or sprinkle our finer woodwork, such as carvings; and it is necessary to have recourse to another process to destroy worms in such work. We are repeatedly asked for recipes for this purpose, and we have given one or two remedies of a simple kind. One of the best modes is to fumigate the carvings or furniture with benzine. This may be done by enclosing the articles in airtight cases or small closets, and then subjecting them to the vapor of benzine, which penetrates the wood deeply. Sponge saturated with the benzine and placed in saucers is the simplest manner of fumigating. The fumes of chloroform have also been found destructive. Or the carvings may be saturated with a strong solution of corrosive sublimate, and afterwards varnished if thought desirable. (Probably the simplest plan is to immerse the article bodily in a bath of naphtha, as recently described in these columns. —EDS. SCI. AM.)

But the fundamental philosophy of the whole question of timber preservation lies in a nutshell. It is the evaporation of the juices and moisture—in one word, seasoning; after which it is only necessary to render wood exposed to wet impervious to it. Ventilation is more of a cure than a preventive, for thorough seasoning includes ventilation, and renders it less necessary; yet it is a precaution, and a very wise one. For wood not exposed, it is far better to leave it alone, or simply varnish it when quite dry.

LE COENTRE'S SOUNDING APPARATUS.



This new sounding apparatus, now supplied under government regulation to all French vessels of war, is illustrated in the accompanying engraving. It is very simple in construction, being nothing more than a small set of blades similar to those of a screw propeller, secured to a vertical shaft. These blades, as the apparatus descends, rotate the shaft, and the number of revolutions are registered by suitable dials in connection with simple transmitting mechanism. The lower part of the device is of lead of the usual weight for deep sea sounding. The principal advantage of the invention lies in the fact of its being indifferent to submarine currents or to rough seas. The blades are rotated only by its downward movement; and of course the more rotations registered, the deeper must be the water. The dials show the depth in meters.

Belting vs. Frictional Gearing.

In the early part of 1872, we published a series of carefully prepared papers on frictional gearing, giving results of experiments therewith, made to determine the percentage of adhesive force or traction of these wheels as compared with belted pulleys. From these tests it appears that the traction of the friction wheels was greater than that of the belted pulleys, and considerably more than is usually supposed to be obtained from belts upon pulleys of either wood or iron; and that, while there is a marked falling off in the adhesion of the belt as the work increases, that of the friction gear increases as the labor becomes greater.

We have lately received a letter from Messrs. Brownlee & Co., of Havelock, Marlborough, New Zealand, which details results considerably at variance with those above noted. Our correspondents say: "We had prepared plans for a saw-mill, to be driven by friction instead of by belting; but before ordering machinery, we came to the conclusion we had better make a trial on the same principles as set forth in the *SCIENTIFIC AMERICAN*" (alluding to the records of the tests given in the series of articles above referred to), "and obtained the following results, which rather staggered us: 'Instead of a 6 inch belt, we used a $3\frac{1}{2}$ inch on 17 inch pulleys. The belt without slip showed that 136 lbs. raised 70 lbs.; 320 lbs. raised 153 lbs. Friction gearing without slip, 136 lbs. raised 57 lbs.; 190 lbs. raised 54 lbs.; and 320 lbs. raised 84 lbs.'"

These last results, though not wholly in accordance with those given by the writer who communicated the articles, are reasonably near; but those given by the belting certainly are wholly out of proportion. Messrs. Brownlee & Co. say that they tried the friction gearing with one half the face, namely, 12 inches, and obtained the same result, that is, the same weight was raised.

This is an interesting question of practice, and probably some of our practical readers can throw some light on the wide discrepancy noted. We should very much like to hear, from mechanics who have tested the relative efficiency of belt pulley and friction gear, their views on the subject.

To rivet cold metal, use a ball-peened hammer.

Useful Recipes for the Shop, the Household, and the Farm.

The relative adhesion of nails in the same wood, driven transversely and longitudinally, is as 100 to 78, or about 4 to 3, in dry elm, and 2 to 3 in deal.

A quick method of screwing bolts that have been put in the lathe is to make two deep cuts along them with the screwing tool, as usual. Then take them to the vise, and with a wrench wind them through a solid die. They will thus be cut as true as though finished in the lathe, and all will be of one size, while at least one half the time will be saved.

To cut off the ends of bolts that were too long and have been turned down: Fasten a chisel in the vise with the cutting edge upwards, and rest thereon the end of the bolt to be cut off; then apply another chisel on the top of the bolt end, and strike as usual with the hammer.

Brass piston rings should have the split sufficiently wide to allow for expansion when hot; otherwise they will expand sufficiently to close up the split and bind in the cylinder thus causing them to cut, or become cut by, the cylinder. The same rule applies to brass piston heads.

Short screws or screws of small diameter, such as are usually cut by screw plates, should be cut as follows: Turn the screws as much too long as the thickness of the screw plate; then, for a distance from the end equal to the thickness of the screw plate, turn down the end of the screw so that it will nearly enter the screw plate without having any thread cut on it; and when the screw plate is applied to cut the thread, the reduced piece on the end will serve as a guide, keeping the screw plate true. The screw will fit down evenly all round the underneath face of the head. This method is much more rapid and as true as that of finishing the threads in the lathe.

Piston rings should be turned inside as well as outside, or that they will not spring out of true when they are split. The time required to turn them inside is not one tenth part of that required to true them in the vise, if they warp from being split.

W. S. G. says: When boils make their appearance, take a teaspoonful of soda in a glass of milk every morning and evening.

G. M. G. says: "To renovate oil cloths, dissolve $2\frac{1}{2}$ lbs. paraffin and 1 gallon oil of turpentine by the aid of a gentle heat, and apply with a sponge or piece of flannel, while warm. Let it remain on the oil cloth 24 hours; then polish with flannel. This solution not only renovates but preserves the cloth. I have used it on oil cloths which have been down 4 years, and they look as good as new. The same preparation may also be used on painted floors. When rubbed with flannel, it will have a beautiful gloss, equal to varnish."

W. L. T. says: To cleanse articles from tar, rosin, or any compounds of a resinous character, the use of flaxseed meal, moistened with water, is recommended.

A Plea for the Wild Elephants.

A correspondent of *Land and Water* calls attention to the slaughter of elephants, arranged to take place at Trincomalee, in Ceylon, on the occasion of the Prince's visit. The elephants are described as roaming about in large herds in the most tame and inoffensive fashion, almost heedless of man, for none have been shot for upwards of twelve months. There is at present such a large class of society in England, who advocate kindness to animals in all its forms, that we venture to predict that, when the battue and shooting down of these semi-tame elephants occurs, the accounts will be received in England by the humane and thoughtful portion of the community with feelings the reverse of satisfactory. It seems a pity to destroy, for the sake of simple sport, such useful intelligent animals as elephants. In destroying tigers and other strictly wild and destructive beasts, the sportsmen perform a public service, and this knowledge doubtless adds additional zest to the enterprise; but the wholesale destruction of these huge and valuable assistants to man, on the plea of sport, when their hunting and capture for domestication would be equally exciting and far more instructive, is a proceeding repugnant alike to the teachings of our flag, and to our humane ideas of advanced civilization. If the risk of life from the furious charge of a wounded bull elephant is required to establish the courage of their future king in the eyes of his Eastern Empire, let some other plan be devised, and let his millions of half-civilized subjects practically associate his visit with recollections of mercy rather than with the wanton slaughter of animals almost idolized for their utility, and tractability—the most powerful, and yet the most docile, creatures in the universe. Wanton waste brings woe-ful want. The commercial loss, though large, in an elephant battue is not of so much consequence as the example. The wanton slaughter of buffaloes of late years on the American prairies, and of moose deer in Canada, has already excited the action of their respective Governments, and nearly every State of the Union has been compelled to pass severe repressive game laws to prevent the extermination of many of the indigenous birds and beasts, and this, too, in a wild country with almost unlimited range. We trust to hear that the royal party will have plenty of sport in every legitimate sense, but elephant battues are not legitimate sport. Sport is a misnomer: it is simple butchery.

The British Admiralty having decided upon the construction of two despatch vessels to be made entirely of steel, the order for the plates and bars for the same has been given to the Landore Siemens Steel Company, of Swansea, who undertake to supply a very mild steel of high quality.

M. SEBILLE, a French architect, injects bricks with tar and finds them impermeable to humidity.

IMPROVED SADIRON.

In the accompanying engraving is represented a new sadiron, which is heated by fire placed within it. Devices are provided for regulating and maintaining a draft and for keeping the smoothing plate at a uniform heat. By this arrangement the frequent warming of the implement is avoided, and time and labor thus economized. As shown in the illustration, a portion of the side is broken away in order to exhibit the interior. The bottom plate is made with a rearward extension and an external box or chamber, which prevents the escape of ashes. On the bottom plate is cast a series of longitudinal ribs, between the ends of which and the walls air passages are left. Said ribs prevent the packing of the fuel on the bottom plate, and also serve to increase the draft which traverses the channels between them. They also make a connecting medium between the fire and the bottom plate, so that the latter, even when covered with ashes, is kept at a uniform heat. B is a partition which is inserted in grooves, and which rests on the ribs as shown. It may either be solid, as at C, in which case the draft passes beneath it, and combustion is confined to the under portion of the fuel, or it may be perforated as represented in place, when the draft is augmented, and a greater heat gained.

The lid is made in two sections, the larger of which, D, is hinged or swung on pivots at the rear, so that it may be turned up to give access to the fire chamber. When down, it is held in place by a shoulder on the front section, E. The latter neatly fits over the forward triangular compartment, and can also be raised to a vertical position, in which case a flange or shoulder, as shown in the illustration, projects over and holds the section, C. The loop attached to the handle holds the front section in an upright position. F is the chimney, constructed to fit in the forward compartment. It may be inserted or removed as desired in order to increase or diminish the draft. The sliding door, at G, admits of shutting off the air supply, and thus extinguishing the fire.

Patented May 18, 1875. It is desired to sell the patent to the highest bidder, between the present time and the beginning of 1876. For further information address the inventor, Mr. R. H. Hasenritter, Hermann, Gasconade county, Mo.

THE CENTENNIAL COMBINATION CULINARY APPARATUS.

The annexed engraving represents an ingenious piece of furniture in which are combined a variety of articles which we presume were never before brought into such immediate conjunction. In the one device there is an ice box and a heating apparatus, which last may be used for any culinary operation or for clothes boiling. There are several useful drawers, besides a receptacle for a constant hot water supply, while the top may serve as a table. The invention is, in fact, a kitchen in itself, and is well suited for the wants of small families living in limited apartments. It obviates the use of the cooking stove, and thus the heat and expense of the same are avoided. It is compact in size, requiring no more room than an ordinary table, and its construction is quite simple.

The top may be extended by the swinging leaves shown, which are supported by jointed braces. These, when the leaves are not raised, fold back into suitable chambers. At A are arranged tanks for heating water and for preparing tea and coffee. B is a tube which conducts gas to the burners, at C. Instead of gas, kerosene lamps may be used. The heat from either gas or lamps warms water in the tank, D, the steam from which is utilized in the steamer, E, through the latter having a perforated bottom. From the steamer the steam enters the worm, F, there condenses, and returns to the tank, D, thus securing a constant water supply in the latter, and also being prevented from escaping into the room. Access is given to the fire chamber by the door shown. The ice box, which is located at G, is made with a perforated bottom, so that it can be used for other purposes if desired. The faucet in connection therewith carries off the waste water.

The steamer may be replaced by a sheet iron pan, having apertures for kettles, spiders, etc., or by a pan adapted for holding as many as a dozen flat irons at once, to heat the same. Also a sheet iron oven may be inserted for baking purposes. The condenser can be inserted and used as a wash boiler, in which case the coil, F, will conduct a stream of water upon the clothes, thus cleansing them more quickly and saving in a measure the work of rubbing them. There is also a bread tray and mixer, which can be used for washing dishes. Bread can be set and raised in the coldest weather in the tray, if the latter be kept slightly warm by means of a small lamp or gas flame.

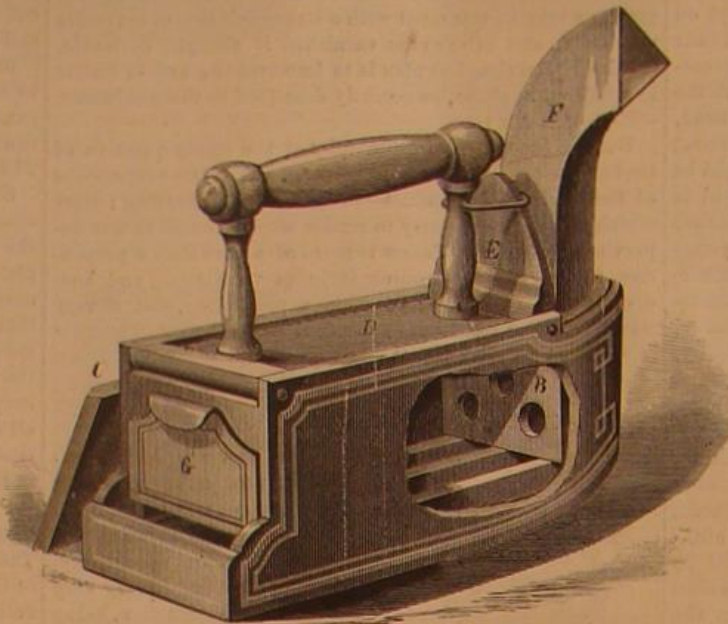
The inventor states that the cost of burning kerosene in his apparatus will not exceed one cent per hour. Of course

heat can be generated or extinguished in a few minutes and readily adjusted to any required degree by simply regulating the lamps or gas. The invention may be found useful for camp meetings, picnics, etc., and might prove especially convenient for families who occupy small apartments in Philadelphia during the Centennial.

Patented September 17, 1875. For further information address Mr. A. J. Randall, Belvidere Seminary, Belvidere, N.J.

Steam as a Fire Extinguisher.

A remarkable instance of the thorough efficiency of steam as an extinguisher of fire in an enclosed space is afforded by



HASENRITTER'S IMPROVED SADIRON.

the report of the master of the steamship Petrarch, of Liverpool. The Petrarch was bound from Genoa to Antwerp, with a cargo of sulphur, etc., and after passing Lisbon experienced very severe weather, and at 10 o'clock A.M. was struck by a heavy sea, which threw her on her beam ends. A loud report was then heard from the forehold, and smoke was discovered arising from the ventilators and hatches. The hatches were immediately opened to ascertain the cause, and the cargo was found to be on fire. The vessel was then put before the wind, and the hose laid on, and four feet of water pumped into the hold. The fire, however, increased; and finding water of no avail, the hatches were battened down and steam was turned on at high pressure from the main engine. At 6 A.M. the cargo was still found to be burning; but at 8 A.M. the fire was mastered, and the vessel then

Still another competitor has made his appearance, and disputes the laurels of the far-famed Keely. Unlike the frank manufacturers of the puzzling apparatus which we illustrate in another column, the new discoverer does not avow his machine to be a trick or clever mechanical problem, but declares it a *bona fide* motor, capable of generating gigantic and colossal power from a ten foot water pressure, and to be operated by mechanism which consists simply of—but that is a secret. The inventor, Mr. Thomas of Chicago, wants to bet Keely \$5,000 that his motor will do all Keely's does and that continuously, and in a few weeks he is going to run a large factory with it, and make an improved machine, and get a patent, etc.

Inter-Ocean describes the new wonder as follows: "Two cylinders, of cast iron, about twelve inches in diameter and twelve inches deep, with appropriate internal pipes, compose the generator, into which a stream of water is admitted at a pressure of about ten pounds to the square inch, and at a velocity equal to that pressure; in other words, the contents of the generator, which consist of pure water and air, only receive the momentum or energy due to the motion of water under a ten foot head. From the top of each of these cylinders rises a cap or receptacle, similar to the air chamber of an old-fashioned fire engine. From the cap on one of the cylinders, a pipe appears to run to the other cylinder; and from the chamber on top of the second cylinder, a tube connects with the reservoir where the power is stored. The reservoir is of heavy iron, and from the top of it rises a hollow pillar of cast iron, like the cylinder of a steam engine, only, of much greater strength. Within the cylinder which has a bore of about one and one half inches plays a rod of iron half an inch in diameter. This rod terminates in a solid cap of iron beveled at top to a knife edge, which is crossed by an iron bar about five feet long. This bar acts on the same principle as the lever of a safety valve, the top of the iron rod being the fulcrum, and the weight on the further end of the lever bearing down on the rod with a force equal to 8,000 on the square inch.

"As soon as the stream of water is permitted to flow into the cylinders of the generators, the motive power begins to collect in the reservoir, and, passing up through a check valve in the bottom of the cylinder, which is above the reservoir, forces the iron rod and the lever up to the ceiling; here its upward progress is stayed by the heavy frame work of the building."

The Germination of Seeds.

Some interesting experiments on the growth of seeds have been conducted by M. Uloth. These were undertaken with a view to determine whether seeds could be made to germinate in ice, and the process may be described as follows: Seeds of various species were placed in grooves made in ice cakes, and over the grooved surface other plates of ice were laid, and the whole removed to a cool cellar in January, and there they remained till the following May. An examination then made disclosed the fact that many of the seeds had actually germinated, the roots penetrating into the ice. It is but natural, says *Appleton's Journal*, that facts of this startling character should give rise to controversy, and so we are not surprised to learn that opposite views are entertained as to whence the heat needed for the process of growth was obtained. In the opinion of the experimenter, it was obtained, or rather liberated, in the growth of the roots while forcing themselves into the ice.

From Norway.

One of our subscribers, resident at Flekkefjord, Norway writes us as follows:

At one of the last sittings of the Storting (the Norwegian parliament) appropriations

were made for a general exploration of the waters that lie between the Faroe Islands, Iceland, Spitzbergen, and the coast of Norway. A body of scientific men is to attend the expedition, which is to start in the spring, next year. A steamer is now being fitted out, at Bergen, for the purpose.

"Advices from Hammerfest state that the Swedish polar expedition arrived at the mouth of the Jenisel river on August 15. Four days afterwards Professor Nordenskjöld left the vessel, to return to Stockholm overland. The vessel arrived at Hammerfest on September 26, carrying with her a rich collection of natural history specimens."

The truest threads in holes are cut from taps having no clearance in the threads. Such taps also cut threads more uniform in size than those having clearance in the thread

The corners of the square head of a tap should be well rounded or chamfered off, so that the wrench will readily adjust itself to the square of the tap.

THE CENTENNIAL COMBINATION CULINARY APPARATUS.

proceeded to St. Nazaire, where she arrived in safety. The master attributes the extinction of the fire and the consequent safety of the vessel to the use of the steam jets.—*Nautical Magazine*.

Look Out for the Sewing Machine Monopolists.

It will be remembered that a signal failure attended the efforts of the sewing machine combination to procure the sanction of Congress last winter to an extension of the sewing machine monopoly. We learn that the combination intend to make a vigorous outlay of money during the coming session in the hope of extending another patent, which will have the same effect which the extension of the former patent would have secured. Indeed, it is said that the matter has been so effectually "fixed" that the extension will be renewed without serious opposition.

BRASS wire should be softened before being used for rivets. To soften, heat and allow to cool or dip in water.

IRONCLAD VESSELS.

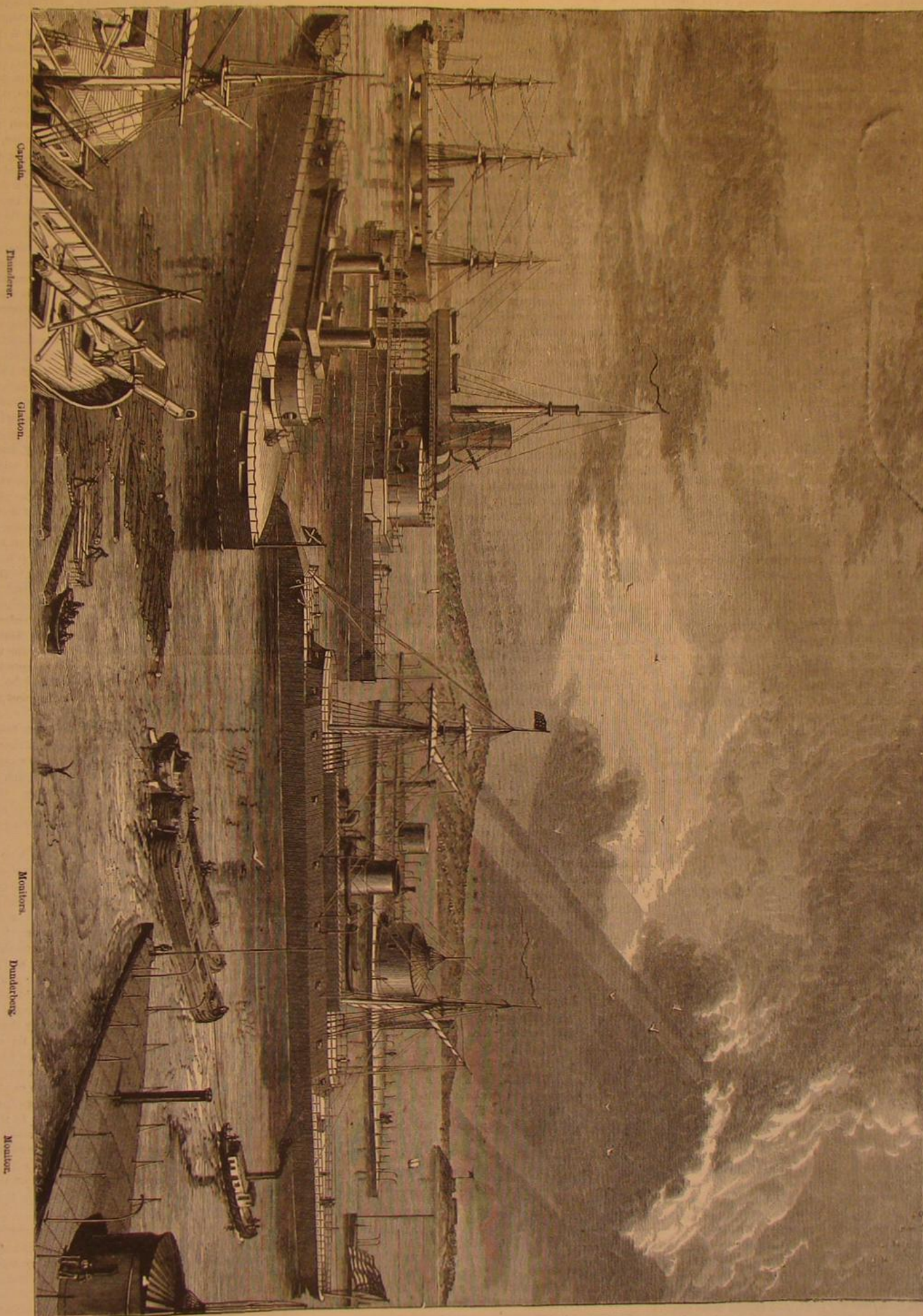
The contest between naval engineers and artilleryists has been of long duration, and there seems to be no flagging in the zeal of either party. In the year 1860, France built the first ironclad, *La Gloire*, and her 4½ inch plates were at that time a marvel. Guns capable of piercing this armor at long range were, however, immediately constructed, and since then the rivalry has been unabated. Twenty-four inches

the heavier a ship's plating is, the more certain she is to be a total loss if she once springs a leak. And, on the other hand, the ships can always be armed with guns as powerful as any that can be brought to attack them; but their sea-going capabilities are reduced, and ironclads of the very heaviest armor and armament will probably be used only for coast and harbor defence. In conjunction with a well arranged system of torpedoes, a few turret ships carrying mo-

the fore-castle and poop were guns of smaller caliber. She was full rigged, and had engines of extraordinary power, and two independent propellers. She carried a crew of 500 men.

The *Thunderer* is another British vessel, without rigging or masts, and may be better called an engine of war than a ship. Her offensive power is very great, consisting of 32 heavy guns and five of the largest pieces of artillery known at the date of her construction. The ship is handled entirely by

ENGLISH AND AMERICAN IRONCLADS.



thick of rolled iron of the finest quality is now used for protecting the turrets of the most recent naval monsters; and a gun of 81 tons weight, capable of sending a shot weighing nearly three quarters of a ton through 24 inches of iron and several feet of timber backing, has been constructed as a specimen, and a gun of 120 tons weight is already talked about. It would seem to be impossible to build a perfectly indestructible vessel; and so far as theory goes, the victory belongs to the artilleryists. It must also be remembered that

modern artillery could make the approach of an invading army by sea a risk that no enemy would care to encounter.

Our engraving represents three English and two American types of iron-plated vessels, each of which shows a different form of turret. The vessel in the distance on the left is the ill-fated *Captain* (English) which foundered off Cape Finisterre, France, in July, 1870. She had two large turrets placed amidships, in each of which were two 25-ton rifled guns, capable of throwing 600 lbs. elongated projectiles. In

steam, and her crew consists of engineers and fighting men. The *Glatton* is a very formidable vessel, carrying four of the largest guns, mounted in a revolving turret. She also depends on steam for her power of locomotion, and has engine room, magazine, and men's quarters below the water line.

The monitors of the United States Navy are familiar to most of our readers. Probably no ships could possibly be built that would offer less mark for an enemy's artillery while they can carry guns of immense weight and destruc-

tive power. For river and harbor defence, they seem to be unsurpassable, combining great destructive force with a minimum of liability to danger.

The Dunderberg was a powerful vessel which was protected from the effects of shot by armor placed at an angle pointing seawards from the ship's sides. She was pierced for 20 guns, and mounted 16; and she had a submerged ram which, propelled by her large engines, would be found terribly destructive in action. This vessel occasioned some discussion among naval authorities at the time of her construction, full particulars of which were given in our volume XVII, pages 85 and 115. A description of her trial trip will be found on page 413 of volume XVI. She was designed and contracted for by Mr. W. H. Webb, and built by John Roach & Son; and she was subsequently sold by Mr. Webb to the French government.

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 objects mentioned. M. M.

Position of the Planets for December, 1875.

Mercury.

On the 1st of December Mercury rises about 6 A. M., and sets before 4 P. M. On the 31st it rises before 8 A. M., and sets before 5 P. M. It is very small in apparent diameter, and is so nearly in range with the sun after the middle of the month that it cannot be seen.

Venus.

Venus is coming rapidly into better position for observers. On the 1st it rises at 8h. 39m. A. M., and sets about half past 5 P. M. in the southwest. On the 31st, Venus rises a little after 9 in the morning, and sets at 6h. 29m. P. M. It should be looked for as soon as sunset, keeping nearly the path of the sun. It will be small but bright.

Mars.

On the 1st of December, Mars will rise about noon and set at 10h. 27m. P. M. It will be seen on the east of Saturn, having, by its more rapid motion among the stars, passed Saturn, which seems scarcely to change its position from night to night. On the 31st of December, Mars rises about 11 A. M., and sets at 10h. 21m. P. M.

Jupiter.

Jupiter rises at 5h. 23m. A. M., and comes to the meridian at 10h. 20m. in the forenoon, on December 1st, setting at 8h. 22m. P. M. On the 31st, it is little better situated, as it rises at 3h. 55m. A. M., and sets at 1h. 42m. P. M.

Saturn.

Saturn is still easily seen in the early evening on the 1st of December, west of the red planet Mars. It sets on the 1st at 9h. 54m. P. M., and on the 31st at 8h. 9m. P. M.

Uranus.

Uranus is among the small stars of Leo. It rises before Regulus on December 1st at 9h. 50m. P. M., comes to the south at 4h. 47m. in the morning, and sets at 11h. 44m. A. M. It reaches an altitude of 63° 48' in this latitude, and can be easily found with fixed instruments. On the 31st, it rises at 7h. 49m. P. M., comes to the south at 2h. 47m. in the morning, and sets before 10 A. M.

Neptune.

By an observer who has a meridian instrument, Neptune can be seen as a small star, when it passes the meridian, on the 1st of December at 9h. 15m. P. M., on the 31st at 7h. 15m. P. M. It is among the small stars of Aries, and may perhaps be recognized by its motion, although the change of place among the stars is very small.

Occultations.

On the 10th of December, the moon's path will lie among the small stars of the Pleiades, and it will pass over or occult some of them by coming between us and their light. As the moon will not be full, and the stars will disappear behind the dark limb of our satellite, the phenomenon is easily seen, can be watched with an opera glass, and affords to the young student an excellent opportunity for learning the moon's rate of motion in orbit. The first occultation occurs about midnight.

Sun Spots.

The report is from October 21 to November 16 inclusive. On October 16 the two elongated spots, mentioned in the last report, appeared to have united, and before the next photograph, October 25, had passed off by the motion of the sun on its axis.

On October 25 two large spots, surrounded by penumbra and followed by faculae, were seen coming on. No change was observed till October 28, when one of the spots seemed to have separated into two; but on October 31, seen through the telescope, these two appeared to have united again.

The photograph of November 3 showed that the two large spots, first observed on October 25, had changed into one huge one; and near the center of the disk, a small spot was seen, which had not been observed before. On November 4 the large spot was seen near the edge, and faculae were again visible. As this spot probably passed out of sight on November 5, if it returns, it should reappear about November 18, and should be seen to traverse the disk. The small spot, near the center, had changed into two when seen on November 4, and after that date could not be found. From November 5 to November 16 no spots have been seen.

On the last page of this paper will be found an advertisement of a new recipe book, just published, which will be found useful companion for reference by every one.

Testing the Fatty Oils.

The value of a fatty oil, especially olive oil, as a lubricant depends greatly on the amount of acid in it. The quantity of acid in the oil determines this value not merely on account of its destructive action on the journals and boxes, but because other qualities, such as fluidity, durability, purity in general, and lubricating power, vary with the degree of acidity. Burstin, chemist in the naval arsenal at Pola, has published a method for determining acidity volumetrically, which has been proved by long experience to be trustworthy. In judging of table oils, the process gives a numerical expression for the degree of rancidity, whereby the quality can be measured. The method is as follows: A tall cylindrical vessel, provided with a ground glass stopper and having two marks on it to indicate respectively 100 cubic centimeters (6.1 cubic inches) and 200 cubic centimeters, is filled to the first mark with the oil to be tested and to the second mark with 88 to 90 per cent alcohol. The cylinder is then closed and well shaken. Equal quantities, other than 100 cubic centimeters, can be employed without any other change in the process. After standing 2 or 3 hours, the oil settles, and the clear alcohol, which contains in solution the free acids and a little of the oil, rises to the top perfectly clear; 25 cubic centimeters of the clear alcohol is taken from the top by means of a pipette. A few drops of an alcoholic extract of turmeric is added, and the acid determined by means of a standard solution of potash, as in acetometry. The change from yellow to brownish red takes place with great sharpness when neutralization is reached. The number of cubic centimeters of potash employed multiplied by four gives the quantity of the normal solution requisite to neutralize the free acid in 100 cubic centimeters of oil. As it is not an individual acid but a variable mixture of acids, it is not possible to calculate the percentage of acid present. These numbers, however, may be taken as degrees of acidity. For instance, an oil of three degrees of acidity is one which contains enough free acid to neutralize 3 cubic centimeters of normal alkali.

If we assume that oleic acid predominates, which in most cases is the fact, one degree of acidity corresponds to 0.28 per cent by weight of oleic acid. The olive oil of commerce has an acidity ranging from 0.4° to 12°. The first passes as very fine, and is called free from acid or salad oil, while the latter is known by smell and taste as strongly rancid. Oil that has 4 to 6 degrees of acidity has been found by experiment to answer very well as a lubricator.

What relation there exists between the degree of acidity and an injurious effect upon metals is shown by the following experiments: Four shallow vessels of sheet brass, having a surface of 40 square centimeters (about 6 square inches) each at the bottom, were filled to the depth of 2 millimeters (0.078 inch) with oils of different acidity, and exposed to the air at the ordinary temperature. The vessels were soon more or less covered with green fatty salts, and the oil too acquired a green color. Oil and vessel No. 1 were the only ones in which no change could be perceived. At the end of twelve days, the vessels were cleaned with ether and weighed. The following table shows the amount of action:

Vessel No. 1, filled with oil of 0.8 degrees, lost 0.03 grain.	
" " 2 " " " 4.6 " " 0.22 grain.	
" " 3 " " " 7.8 " " 0.36 grain.	
" " 4 " " " 8.8 " " 0.4 grain.	

The quantity of metal destroyed in equal times and under equal conditions increases with the acidity of the oil.

This volumetric method of determining the amount of acid extracted from the oil is so simple that a person who is not chemist can with a little practice perform the operation if he can obtain from a chemist the normal potash solution. There is, however, a still more simple method, invented by the same person, which depends on the fact that the more acid has been taken up by the alcohol the heavier the latter becomes. It is only necessary to be provided with two cylinders, a sufficient quantity of alcohol, and a delicate hydrometer or alcoholometer. In one cylinder is placed the pure alcohol employed, and its specific gravity is taken; in the second cylinder the oil and alcohol are shaken up together, and when they have separated the hydrometer is transferred to the supernatant alcohol and its specific gravity taken. The greater the difference in the specific gravity found, the larger is the percentage of acid in the oil tested. There must, of course, be alcohol enough above the oil to float the hydrometer without its touching the oil. The hydrometer must be very delicate, so as to read to the fourth decimal place, and the scale need only extend from 0.825 to 0.850.

Burstyn is engaged in preparing a table to show the acidity corresponding to different readings of the hydrometer for alcohol of 88 to 90 per cent when the acidity ranges from 0.5° to 12°. The following table shows a few of his results:

Oil No.	Acidity volumetrically.	Specific gravity of wash alcohol	Specific gravity of clean alcohol employed.
I.....	0.8	0.8324	0.8300
II.....	2.2	0.8328	"
III.....	2.8	0.8330	"
IV.....	4.6	0.8336	"
V.....	7.8	0.8345	"
VI.....	8.8	0.8346	"

If some of our numerous and ingenious Yankee hydrometer makers will put a suitable instrument in the market, with large bulb and short scale, we may soon expect to see this quick and simple method of testing oils introduced into practice. It will not only prove very serviceable to the owner of machinery by easily and quickly informing him whether the oil in question can be used for lubricating, but it will also be useful to dealers and producers, because it enables

them to judge, without special difficulty, of the value of their wares, and to know whether the process of refining has gone far enough.

It will scarcely be possible to mix adulterants with the oil so as to conceal the acid and render this test invalid, because the substance added for that purpose must be lighter than alcohol, must be soluble in alcohol as well as in oil, and free from odor, three difficult conditions to fulfil.

Irresolution.

An editorial under the above title, which appeared in a recent issue of the Philadelphia *Ledger*, has attracted our attention as possessing sound reasoning on a very common failing among business people. We make the following extracts:

"There are few conditions of mind more painful to endure, and more fatal to efficiency or success, than irresolution. Most of us can recall occasions when we have been thus afflicted, hesitating anxiously between two opposite courses, preferring first one and then the other, as their several advantages present themselves, becoming each moment more confused and uncertain, and, though vexed and ashamed of the delay, yet utterly unable to end it by a decision. We may be happy, if such a condition is rare and exceptional with us: if our usual habit is to think deliberately, decide resolutely, and act firmly.

"The irresolute man is continually wasting energy. The power that should be economized for action he consumes in anxious alternations of opinion. Does he propose a journey, a business enterprise, or some change in his mode of life, he is torn with conflicting thoughts as to its desirability. The inducements to carry it out appear in glowing colors, and he thinks his purpose is settled; then possibilities of failures and fears of disappointment bear on him so strongly that he almost renounces it. Again convictions of its benefit press with renewed force, and he oscillates most painfully between the two courses, not having sufficient firmness either to undertake or relinquish the enterprise. Meanwhile the delay itself frequently settles the matter: the time in which he might have chosen for himself passes away, and he is forced to accept what fate has left him without any reference to his judgment or preference. Directly the power of choice is removed, all the advantages of the opposite plan rush upon him with tenfold force; he is sure that that would have been his selection had the opportunity been prolonged; and consequently, acting upon compulsion, without heart or faith, and, indeed, against what he now thinks his better judgment, his failure and his discontent are both insured. In the smaller details of life, this irresolution, if less disastrous, is even more vexatious and annoying. To waver about trifles, to hesitate, and doubt, and balance probabilities upon every little matter that presents itself for immediate decision, is a lamentable waste of power, distressing to one's self, and irritating to every looker-on. It is better to make some mistakes, we should all declare, than to thus constantly lose time and force in debating the *pro* and *con* of each petty action.

"A habit of self-dependence is one most important ingredient in a resolute character. He who, either from inclination or the force of circumstances, has always leaned upon others, can hardly be expected to show much energy in decisions, or much inflexibility of purpose. It is just here that freedom becomes so palpable a blessing, giving to every man and woman the opportunity for acquiring a self-reliance that nothing else can supply.

"It is perhaps hardly possible for one who has attained maturity with a vacillating, irresolute nature ever to become a decided and resolute character. Still there are various degrees of this valuable quality, and it is within the power of each individual so to discipline himself as to strengthen and increase it. A thoughtful survey of every important subject on which we are called to decide is necessary to this end. There is a time for deliberation as well as for action, and when the former is crowded into the latter a wise decision is impossible. All aids to this end should be warmly welcomed, not as props to support our weakness but as means to correct our judgment. The inflexibility that refuses to receive such aid and only seeks to enforce its own will is obstinacy, not decision. When, however, we have brought all foreign helps into connection with our own judgment, and have thus formed the best conclusion we can in the time allowed, we must, as far as possible, dismiss further consideration and proceed to immediate action. In the less important details of daily life, we shall not greatly err in forcing ourselves to an immediate choice, though we may still question its wisdom. This self-compulsion will be most salutary, especially if we cultivate the habit of revisiting our actions with a view to avoiding in the future the mistakes into which we may have fallen."

HERR KRUPP, the famous cannon founder of Germany, has just astonished the British Government by a positive refusal to sell one of his great guns to England, remarking that he was willing to contract for the arming of as many forts and ships as England wanted, but he must decline to part with specimens for experimental purposes. "Considering that Herr Krupp has, in a great measure, learnt the art of big gun making from England," we do not see, says the *Ironmonger*, "why he should be so *krup* when asked, out of compliment, to send one of his big imitations to us."

FOR truing an ordinary oilstone for sharpening planes, take a sheet of glass paper No. 2, and place it on the bench. Rub the stone over it. In this way the stone can be trued in one quarter the time required by the ordinary process.

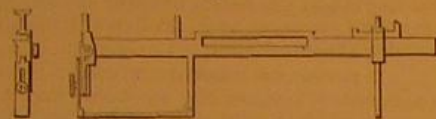
MISCELLANEOUS USEFUL INVENTIONS.

We select this week, from Knight's "Mechanical Dictionary," a series of interesting series of machines relating to the gaging and setting of axles. We also give illustrations of a variety of baggage checks, from which a good idea of the many ingenious devices, which have been invented for insuring the safety of baggage, may be gathered. Two novel forms of awning, a couple of useful instruments, and some tools complete the list of inventions here presented.

AXLE GAGES

are represented in Figs. 1 and 2. By these implements the spindle is so adjusted in relation to the axletree as to give the required swing and gather. The swing is adjusted to give the downward inclination, and the axle is bent to conform to this guide. The gather is given by the adjustable standard. The swing is the outward inclination of the top of the wheel, and is to meet the requirements of the conical

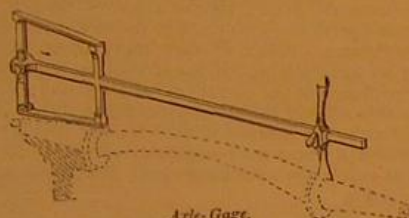
Fig. 1.



Stratton's Axle-Gage.

axle, so that the bottom edge of the spindle shall ride out horizontally. Were the spindle destitute of swing, the wheel would ride outward, bearing heavily against the linch pin or nut. The gather is the forward inclination of the spindle relatively to the general line of direction of the axletree. Fig.

Fig. 2.



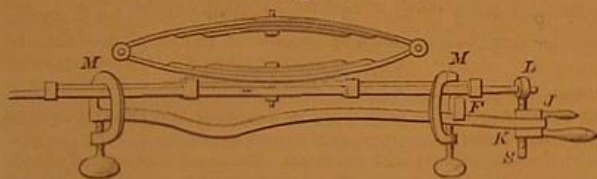
Axle-Gage.

2 shows a gage in which the concave end of the sliding gage is placed on one spindle and the other spindle is set by adjustable bars. The

AXLE SETTING AND ADJUSTING MACHINES

are shown in Figs. 3 and 4. The first is for setting the spindles true on the ends of the axletrees, giving them the required set and gather. The uprights, A C, on the frame, B, are adjustable to any distance. The upright, C, has a jointed

Fig. 4.



Axle-Adjuster.

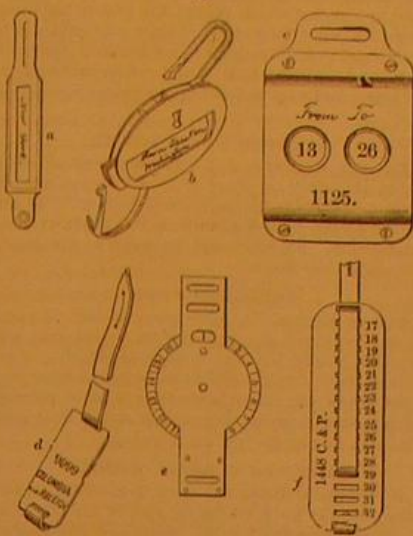
bar, D, projecting from it, which rests on a screw rod, E. This bar is a straight edge, to show the taper of the axle; for when the same is placed on the uprights, and the stop, F, brought up to it by the screw, the taper will be given by the gage, G, shown in dotted lines. If the axle does not touch the stop, F, it is too high on the end, and must be brought down by the blacksmith. If it touches at the end and not at the shoulder, it is too low and must be treated accordingly. The axle is then turned end for end, and the operation is repeated. The T end on the frame is to set the T foot of the gage against, as shown. The angle of the gage is obtained by setting the gage foot against the spoke, and putting the straight edge, H, in the axle box, as in the smaller figure. A more portable form of the same general character is shown in the axle adjuster, Fig. 4. It consists of a bar hooked to the axle tree in two places. The bar is fastened by the clamp, M, and fulcrum block, F. The eyebolt is hooked over the end of the spindle, and the adjustment of the latter is accomplished by the screw, S, and set nuts, J K.

BAGGAGE CHECKS.

In Fig. 5, a shows a label holder of two metallic portions, which serve as a frame for a card, on which is inscribed the destination. b is a lock-up case for several of such cards, any one of which can be exposed as desired. c has two series of numbers on wheels, and the places of departure and destination are indicated by numbers agreeing with the schedule of stations. d has the places of departure and destination on the sides. Either reading may be hidden by the strap. On the return trip the other side of the check is shown by the inverse reeving of the strap. e has a disk with a circumferentially numbered margin. A number agreeing with the schedule number of the station for which the baggage is bound is exposed at the opening on the plate. By an arrangement of the strap, the latter is made to hold the disk so as to secure the required presentation of the figure. f has a series of station numbers in a row; the strap is so rove through the slots as to indicate the station (29) at which the baggage is to be put off. g is a metallic case inclosing a card with the numbers of the stations printed thereon. A

punch mark indicates the station of destination (14 in the engraving). The strap holds the parts of the case together. h has a dial plate and pointers, which indicate the stations of

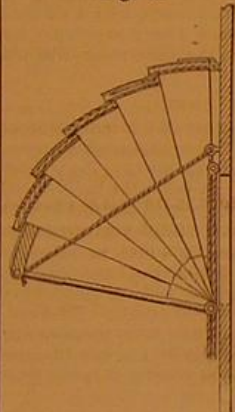
Fig. 5.



Baggage-Checks.

departure and destination. i is a metallic disk with radial slots and corresponding numbers. The strap is so rove through the slots as to give the required indication. The

Fig. 6.



Arched Awning.

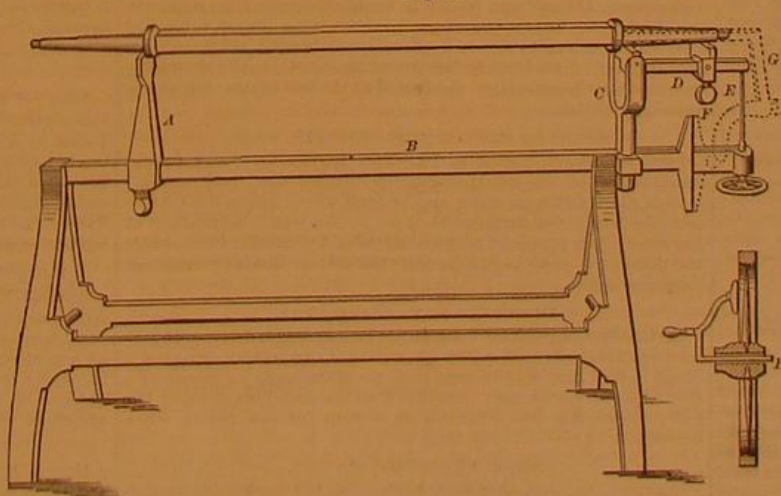
AWNINGS,

shown in Figs. 6 and 7, are made in two forms. In Fig. 6 the lower edge is attached to the boards which are secured to the side extensions, which are made in toggle sections, operating as lazy tongs. The upper edge is coiled on a roller held by a pawl. A spiral spring keeps the arm extended. In Fig. 7, front and tapered side slats slide one beneath the other, and are connected by plates with headed studs which work in slotted plates affixed on the adjacent slats. The end slats collect like the folding parts of a fan; the roof slats take position in vertical parallel series when closed. The

ALLOY BALANCE,

represented in Fig. 8, is intended for weighing those metals whose proportions are stated decimally, being constructed on

Fig. 3.



Gorton's Axle-setting Machine.

the principle that weights in equilibrium are inversely as their distances from their points of support. The point of suspension, a, of the balance is adjusted until the arms are respectively as the two stated proportions, say 17 tin to 83 copper. The half of the beam is divided into 50 equal parts, numbered from one end; and the point of suspension being adjusted proportionally, the weight, w, is brought to a position where it enables the beam of the empty balance to stand in equilibrium. A quantity of copper being then placed in the scale suspended from the short arm will be balanced by the proportionate quantity of tin in the other scale.

THE BAROMETROGRAPH.

Fig. 9 is a self-adjusting barometer. The pressure of the atmosphere affects four metallic boxes having undulated faces. In each of these a vacuum exists, and they are attached together, so that, for an equivalent variation of pressure, the movement is four times greater than for one box only. A strong steel spring, R, acts upon the boxes against the atmospheric pressure, and controls the lever, L, at B.

The indications of the lever are registered as follows: A cylinder, C, is revolved by clockwork, and makes one revolution per week. It carries blackened paper, against which the

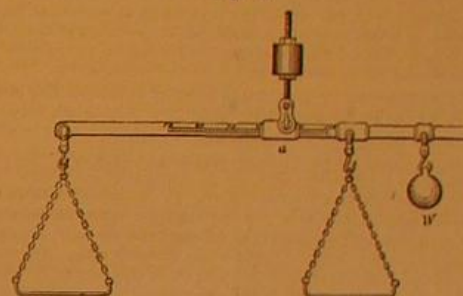
Fig. 7.



Lazy-Tong-Extension Awning.

point of a spring attached to the lever rests, tracing a white line on a black ground. At the end of each week the paper is changed for a fresh one, the record on the old one being

Fig. 8.



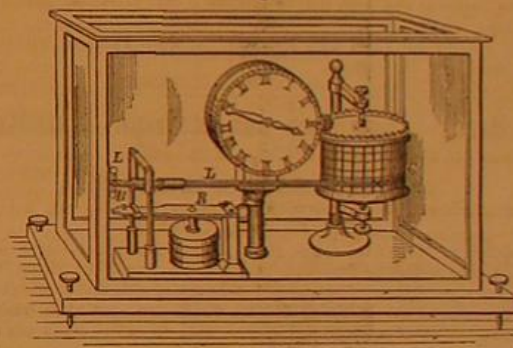
Robert's Alloy Balance.

protected by a coat of varnish.

AWL HANDLES

are represented in Fig. 10. The first is a locking pliers,

Fig. 9.



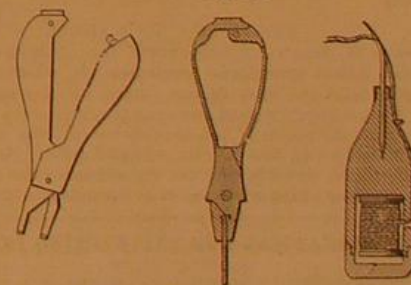
French Barometograph.

whose jaws are adapted to hold either of the tools; those not in use are inclosed in the hollow handle when the latter is closed. A boss on the end of the handle forms a hammer. The figure shows an elevation open, and a section closed.

The eye-pointed awl, also represented, introduces the thread. Fig. 11 is an

AXE TESTER.

The axe to be tested is slipped upon the bar, Fig. 10.

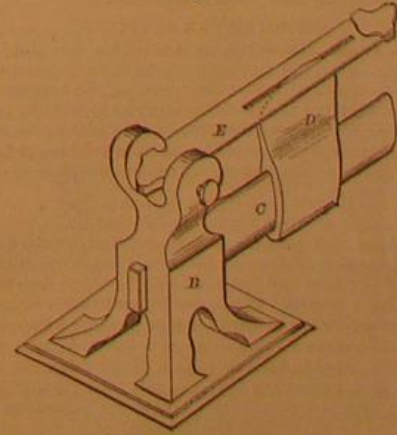


Axe-Handle.

Lasting-Axe.

C, toward the standard, B, until it fits tightly. The gage plate, E, is then allowed to descend upon the edge of the axis, D, when, by placing the eye over the slot, the slightest variation in shape may be detected.

Fig. 11.



Axe-Tester.

NEW BOOKS AND PUBLICATIONS.

THE NEW METHOD OF GRAPHICAL STATICS. By A. J. Du Bois, C.E., Ph. D. With Sixty Illustrations. New York city: D. Van Nostrand, 23 Murray and 27 Warren streets.

In this book, Dr. Dubois calls the attention of the profession of engineering to the value of the graphic method of solving problems in statics, the study of which will enable the reader to investigate many practical questions. The method is of general application in resolving the direction of forces, and in determining the center of gravity and moment of inertia of areas and solids. The first chapter elucidates Professor Clerk-Maxwell's method of diagrams, found on the parallelogram of forces; and elsewhere in the work, Culmann's method of the equilibrium polygon receives much attention. The subject, however, is a very large one; and although the author states that he does not attempt even to outline its complete development, he has succeeded in giving an interesting presentation of this valuable system of calculation.

THE USE OF STEEL FOR CONSTRUCTIVE PURPOSES: Method of Working, Applying, and Testing Plates and Bars. By J. Barba, Chief Naval Constructor at L'Orient, France. Translated from the French, with a Preface by Alexander L. Holley, C.E. Price \$1.50. New York city: D. Van Nostrand, 23 Murray and 27 Warren streets.

Steel is rapidly superseding iron for all purposes where durability is the chief essential; and the Bessemer and Siemens-Martin processes are giving us steel at an advance on the price of wrought iron which becomes nominal when the superiority of the former metal is taken into consideration. The most important English railroad has for some time built its locomotives of Bessemer steel, the wheels being the only important parts that are made of iron. M. Barba's work contains some very interesting descriptions of war vessels built of steel, especially three large vessels built in 1873 by M. De Bussy, an eminent French naval engineer. The French government, being entirely satisfied with the work, has ordered three more to be forthwith constructed, in which steel will be used for all parts not in direct contact with sea water. The book is an exhaustive treatise on its branch of industrial science, and will deservedly meet with an extensive sale.

THE MAINTENANCE OF HEALTH, a Medical Work for Lay Readers. By J. Milner Fothergill, M.D., M.R.C.P. New York city: G. P. Putnam's Sons, Fourth avenue and 23d street.

This work is one of the most sensible treatises on the subject that we have ever read, and it is almost the only one in which some pet nostrum or wild theory of the author does not find a place. Dr. Fothergill does not deal in panaceas or fanciful ideas as to diet and regimen; but he has succeeded in giving a clear and complete history of all that bears on man's physical well being, and he has done this in a forcible and accurate style. The book deserves to become a standard authority with those who rely on the teachings of Science, while its moderation and good sense will commend it to the many who are nauseated with the flood of quack literature which is annually issued on this subject.

SEWERAGE AND SEWAGE UTILIZATION. By Professor W. H. Corfield, M.A., of the University of London, Author of "Water and Water Supply." Price 50 cents. New York city: D. Van Nostrand, 23 Murray and 27 Warren streets.

This excellent and well written treatise is No. 18 of the publisher's Science Series.

THE ORIGIN OF LIFE AND SPECIES. A New Theory. Pittsfield, Mass.: W. H. Phillips.

Recent American and Foreign Patents.

NEW AGRICULTURAL INVENTIONS.

IMPROVED COTTON PRESS.

Daniel S. McBryde, Good Hope, Miss.—The object here is to afford simple mechanism and considerable power in direct line. The press consists of longitudinal supporting sills and guide pieces for the rods of the follower blocks, which are moved forward by the gearing of pivoted sector pieces, with eccentric segments of a centrally pivoted lever.

IMPROVED FEED CUTTER.

Robert J. Wylie, Marietta, Ill.—This inventor combines eccentric gearing with the shaft that carries the knife, and with other portions of the machine, so that the construction is simplified and at the same time greater power exerted in operating the knife.

IMPROVED PORTABLE COTTON GINNING, ETC., MACHINE.

Julius L. Toole, Williston, S. C.—This is a portable power apparatus for driving a gin and condenser (also applicable for other purposes). With it the inventor, in an ingenious manner, has combined a gin, also a condenser and a press, which is attached to the machine, so as to receive the cotton from the condenser ready for pressing.

IMPROVED CORN MARKER.

Thomas B. Kirkwood, Bentonville, Ind.—This inventor offers a new and useful agricultural implement, in which a cutter board swinging from the axle carries cutters on its under side. The shovels are centrally slotted and seated over the cutter, and the latter presents the points of the shovels for catching on stones, etc. The guide-marking pole may be swung to either side of the main board without necessitating the detaching of the pole when the guide-marking board is to be used at the opposite side.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVEMENT IN MAKING PATTERNS FOR CASTINGS.

William E. Craig, Indianapolis, Ind.—This is a new and doubtless useful idea for making elaborate patterns for ornamental iron work, etc., and one that is calculated to ensure considerable economy in time. The workman first models the form of the article in potter's clay. From this he takes a plaster mold, on which he casts a back mold also in plaster. In the last he casts a pattern made of a composition of beeswax, red lead, and resin. This is put back on the back mold, using it as a follow board, and on it is made another mold from which the sand mold is produced.

IMPROVED CAR COUPLING.

James B. Smith, Hopworth, Canada.—This coupling is so constructed that, when the drawbars approach each other, their front hooks pass alongside of each other, pressing the drawbars sidewise until the hooks strike the side spurs (acting as buffers) back of the same. Guard springs are then called into action, bearing on the drawhead of the opposite coupling, so as to produce the secure interlocking of the hooks, and prevent the uncoupling in connection with the side spurs.

IMPROVED GAS APPARATUS.

Charles Lord and Bernard J. McCabe, Shelbyville, Ind.—These inventors propose a new means for converting crude or refined coal and natural oils into more permanently fixed gas than they can be in the ordinary retorts. The essential novelty is a contrivance by which a clay retort can be used for this purpose without injury by the oils, which, when coming in contact with the clay, saturate and disintegrate it, so as to destroy it in a short time. This is accomplished by first vaporizing the oil in the feed pipe, and then discharging it into the iron retort, where the vaporizing process is continued, so as to destroy the penetrating power, and then discharging it into the clay retort, where it is subjected to greater heat than the metal retorts are capable of sustaining, and is thereby

converted into fixed gas. The iron retort is so constructed that any oil that may flow into it cannot escape until it is vaporized.

IMPROVED WATER WHEEL.

Adam W. Haag, Fleetwood, Pa.—In this invention the novel features consist in a spring which throws the points of the gates into notches in guides when they close, to shut said gates tightly; also in cams, contrived to hold the rings and buckets shut; a V-shaped rib, which presses into the flow of the penstock, to pack tight and prevent leakage; and a shaft bearing in two parts, secured together by a ring.

IMPROVED HORSE POWER.

William I. Grant, Magnolia, Ark.—This is a method for attaching the sweeps to the shaft or king post of the ground wheel by a frame attached to arms radiating from the shaft. The sweeps are thus supported on the opposite sides of the shaft at considerable distance therefrom. An increased leverage is obtained, and the king post is made very firm.

IMPROVED PUMP.

William Young, Easton, Pa.—The pump barrel is attached to a vulcanized or galvanized gas pipe, which passes into a base plate and also into the handle bracket, in both of which it is adjustable. A waste valve attached to the pipe is arranged to close by the pressure of water when the pump is working, and is provided with a spring which opens it when the pump stops, thus allowing the water to run out, and so preventing freezing.

IMPROVED TURBINE WHEEL.

Thomas H. Clark, Helena, Montana Ter.—This wheel receives the water horizontally upon the upper part of the buckets, through stationary chutes surrounding the same, and discharges it vertically and rearwardly. The novel features are a vertically adjustable gate with the apparatus for operating it.

IMPROVED LATHE FOR TURNING OVALS.

Louis K. Scottford, Burlingame, Kan.—In this machine, revolving cone pulleys turn on a stationary center, and have a face plate fitted on the face of said center so as to slide freely forward and backward. This slide, which is to carry the work, has a slot which works on a stud, projecting from the stationary center, so that it can be shifted toward and from the axis. This causes the plate to slide, more or less, according to the distance the stud is located from the center. The arrangement is a very simple one for oval turning.

IMPROVED VENTILATING APPARATUS.

John C. Bates, Cold Spring, N. Y.—This inventor proposes an apparatus for ventilating rooms by introducing any desired amount of fresh air in such a way as not to produce a draft, and by which the foul air may be expelled from the room, thus causing a circulation and keeping the room thoroughly ventilated. A horizontal pipe communicating with the outward air has a drum pierced with flues interposed between the register and the hot air flue. The said inlet pipe is combined and communicates with a vertical pipe, which delivers the air into the room in a vertical column far enough above the heads of the occupants to relieve them from the bad effects of a draft.

IMPROVED PARALLEL PLIERS.

Henry R. Russell, Woodbury, N. J., assignor of one half his right to Isaac S. Russell, New Market, Md.—This relates to pliers, vises, etc., in which the jaws are constructed independently of the pivoted handles for working them, and are so pivoted to the handles and provided with guide pins that they always work parallel to each other, while the handles turn on a pivot. The device consists of open-ended grooves in the jaws for the guide pins, so contrived that the guide pins may be permanently fixed in the handles before the jaws are attached, and then be engaged with the jaws when they are applied by sliding into the open-ended grooves. This contrivance allows of fixing the pins in the jaws more permanently than they can well be when the pins have to be put into the handles through slots, and of dressing out the grooves to make them true and smooth by a milling tool.

IMPROVED RAILROAD JOINT.

James G. Holliday, Pittsburgh, Pa., assignor to himself and Frank E. Hutchinson, same place.—This inventor has devised a plate for binding the rails on the ties, arranged under a shoulder of the fish plate, and contrived to form a lock for the nuts.

IMPROVED METAL SHEARS.

Thomas C. Livesay and Henry H. Black, Montana City, Kan.—In this device we have a novel mode of applying the movable and stationary cutters to the bed of a lever-shearing machine. An edge-curved cutter is made fast to and raised diagonally above the bed, and the lever-cutter is pivoted to the bed at one end of the stationary cutter.

IMPROVED BULL WHEEL FOR OIL WELLS.

John Schellkopf, Tidiloute, Pa.—This invention relates to the construction of the wheel commonly termed the "bull wheel," used in derricks for oil wells, and around which passes the rope or chain by which the implement used in the well is hoisted out of the same. It is proposed to make the wheel of sections attachable and detachable from each other and the hub or shaft by means of fastening bolts.

IMPROVED CAR VENTILATOR.

Archibald Hance, New York city.—In this device a series of pivoted ventilators or valves are connected at one side by means of a strap, so that they may be operated simultaneously by means of a curved pivoted rack bar. Another (and the main) function of the valve-connecting bar is to act as a stop for the valves when opened.

IMPROVED PUMP BUCKET.

Eugene J. Dunbar, Romulus, Mich.—This is a bucket for suction pumps, so constructed as to fill the cavity of the pump cylinder at each upward stroke, and to open at each downward stroke. The device is made of india-rubber, in cylindrical form, with a bell-shaped cavity in its lower end, and with longitudinal holes through it. There is a conical iron valve, and a rod for limiting the action of the same.

IMPROVED PISTON PACKINGS.

Christopher R. James, Jersey City, N. J.—This inventor proposes a series of packing rings tapered on the inside to correspond with a spring, and so placed that the spring presses them out against the cylinder, and also against the piston and follower, thus tightly packing the joint.

NEW WOODWORK AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED METHOD OF CONSTRUCTING JAILS.

John A. Seeber and James C. Croxton, Rockwall, Tex.—One of the most important subjects brought to the consideration of the Prison Congresses lately held in England, and to which the Prison Association and other philanthropic bodies are giving much attention in this country, is the proper construction of jails. The present inventors offer a new plan of construction, mainly directed to ensuring good ventilation. The intermediate space of the double floor is constructed with diagonal channels, running from the outer walls to

the center of the building, with grated openings in the walls, and similarly grated openings at suitable points of the upper part of the floor. The different compartments are thus supplied continually with fresh air entering from the outside and passing to the inside. The outer walls serve for the purpose of ventilation and security in the same manner as the floors, and are also provided with air flues, having grated entrance and exit openings at different points, for supplying air without the possibility of communication with the outside, so that no tools, etc., can be introduced. The different stories are ventilated in this manner, and the bad air carried out through the grated inside doors.

IMPROVED EAVES TROUGH.

Otis W. Stearns, Johnson, Vt.—This eaves trough may be conveniently put up, and may be made of any desired length. It is formed of semi-cylindrical sections, made with half ring tenons upon their ends, and semi-cylindrical couplings, made with half ring sockets in their edges, and provided with spikes for securing them to the wall.

IMPROVED DUMPING WAGON.

Albert A. Hoch, Reading, Pa.—This is a new form of that class of dumping wagons which are provided with chutes or troughs to facilitate discharge of their contents. The essential features are a hinged door and hinged side guards, arranged and connected with a hinged chute and the wagon body. The whole forms a very simple and doubtless effective device.

IMPROVED WEATHER STRIP.

Francis A. Bradshaw, Lebanon, Mo.—In this we have a weather strip for doors by which no water is allowed between the door and the threshold strip, and the drip water is carried off in effective manner. An adjustable elastic weather strip fits on the threshold strip, that is provided with a groove and outwardly inclined mortises for the drip water. The groove is covered by a perforated metallic plate.

IMPROVED LAMP CHIMNEY.

George M. Bull, New Baltimore, N. Y.—This inventor patented a lamp chimney on January 9, 1872, and now proposes to make it simpler in construction and less expensive. To this end, around the edge of a rectangular plate is formed a narrow upwardly projecting flange, which covers the outer side of the lower end edges of the transparent plates. Plates of thin sheet metal are bent longitudinally at right angles, the lower ends of which fit into the angles of the flanges at the corners of the plate, and are designed to receive the side edges of the transparent plates. The upper ends of the angular strips are inclined inward slightly, giving to the chimney the form of a truncated rectangular pyramid. Novel devices are added to enable the mica plates to be put in and taken out, as may be required.

IMPROVED CRADLE

Fredrick Voigt, New York city, assignor to Feust and Rice, of same place.—In this invention the connection of the bed posts with the connecting main frame is made in a strong and substantial manner without the use of fastenings or other hardware, and a rigid interlocking of the parts is obtained, together with an easy detaching of the same.

NEW HOUSEHOLD ARTICLES.

IMPROVED WASHING MACHINE.

John Henry Conaway, Nelsonville, Ohio.—The mechanism of this washing machine is so constructed as to wash the clothes by rubbing them in a manner analogous to hand-rubbing. More or less pressure may be applied to the clothes, as may be required, and any desired part of them may be rubbed.

IMPROVED SASH HOLDER.

Hiram Torrey, Philadelphia, Pa., and Darius Lyman, Washington, D. C.—The invention relates to a device designed for application to a window sash for the purpose of arresting and supporting the same by frictional contact with the jamb. The chief elements of the device are a movable or adjustable elastic wedge, and an elastic roll mounted on a fixed pivot, the former being connected with a pivoted spring lever and so arranged as to adapt it for insertion, between the roll and jamb, to lock the sash.

IMPROVED WASHING MACHINE.

Irvin A. Shaw, Grand Meadow, Minn., assignor to himself and John E. Joslyn, of same place.—This is an ingenious combination of mechanism in which rollers, springs, and an endless apron play the principal part, the effect being that the clothes are alternately drawn through the water, and then between rollers, and are thus washed clean very quickly and without being injured.

IMPROVED KEY HOLE GUARD.

John La Blanc and Xavier St. Pierre, Ophir city, Utah Ter.—In this we have a little plate made to slide over the outside key hole of a lock by a knob on the inside. The knob works the plate by a crank and connecting rod, turning them down below the center of the crank on a stop pin, when the slide covers the hole, so as to effectually prevent the slide from being forced back except by the knob. The sliding cover is secured behind an outer case, so as not to be wrenched off.

IMPROVED WRINGER ATTACHMENT TO WASH TUBS.

Andrew W. Caldwell, Gainesville, Ga.—Laundresses unprovided with mechanical wringers have no easy task in wringing out by hand large articles of clothing, etc. The present inventor suggests an ingenious way of assisting them, which consists in a strap passed through a loop of the tub and easily adapted as to length. By this, one end of the article is tightly held, while the other is twisted in the usual way.

IMPROVED FIRE DOG.

Drazen S. Hale, Estillville, Va.—In this invention the fire dogs are so constructed as to keep the fire held up against the back stick. They are made with a wide open hook at their upper ends, and their lower parts are bent downward at right angles, and formed either with or without an offset. Racks are combined with the dogs to hold them in place.

NEW CHEMICAL AND MISCELLANEOUS INVENTIONS.

IMPROVED TAILORS' DRAFTING APPARATUS.

Matthew C. Ten Eyck, St. Paul, Minn.—This is a conformator and transfer or scarf for drafting garments to fit the upper part of the human body, giving the true pitch or slope of the shoulders and the true balance of all other essential points with the same, thereby insuring an accurate fit.

IMPROVED GUN SIGHT.

William M. Treadway, Port Henry, N. Y.—Mr. Treadway suggests that a better aim can be taken with a rifle, and that at the same time the piece may be more accurately kept at the same elevation for every shot, by placing an adjustable spirit level across the rifle and between the sights.

APPARATUS FOR CLEANING LOCOMOTIVE ASH PANS.

Paul K. Dealy, St. John, Can.—The novel feature here is the combination of the steam boiler of the locomotive (by a steam and water pipe) with the ash pan, the pipe extending through the ash pan and branching out into a number of issuing pipes, that clean effectually the ash pan by means of water or steam, as required.

Business and Personal.

The Charge for Insertion under this head is One Dollar a Line. If the Notices exceed Four Lines, One Dollar and a Half per Line will be charged.

Gear wheels and index plates, all sizes, made to order at T. B. Jeffery's, 233 Canal St., Chicago, Ill.

Save 25 per cent of your fuel, or get same amount extra power, by applying the R. S. Condenser, T. Sault, Consulting Engineer, General Agent, New Haven, Conn.

Nearly every advertiser, who makes advertising pay, contracts through a responsible Agency, experience having taught them to avail themselves of the services of those who have made the business a study. The Agency of Geo. P. Rowell & Co., No. 41 Park Row, New York, is the most competent in the country, and many of the largest advertisers make all their contracts through them. —[Exchange.]

The best Varnishes in the market are those made by the London Manufacturing Company. They have been tried and tested, and in every case have been found superior to all others.

Painters and Grainers, send at once for Sample and Catalogue of the Celebrated Metallic Graining Tools; 40,000 now in use. Address J. J. Callow, Cleveland, O.

Wanted—Boring Mill for Cylinders and Wood Shaping Machine. Address P. O. Box 2132, New York.

Launch Machinery Wanted, new or second hand, from 2 to 6 H. P. Morgan's Steamboat Works, Noank, Ct.

Wanted—Address of the person who makes dumb waiters for houses. J. L. Alberger & Co., Buffalo, N.Y.

My time is closely taken up—Hence I will sell two useful Patents. Address D. Munson, Indianapolis, Ind.

How to lay out the teeth of Gear Wheels. Price 50 cents. Address E. Lyman, C.E., New Haven, Ct.

Good Patent for Sale—Wm. H. Rishel, Agent for Patents, Chambersburg, Pa.

Wanted—A Kettle Moulder—Kettles one half to two lbs. Address Gillett's Iron Works, Lake City, Minn.

2,000 feet leather Fire Hose, Cheap; warranted to stand 90 lbs. Address E. M. Waldron, Providence, R.I.

Wanted—Second Hand Milling Machine. Send full description to P. O. Box 611, Providence, R.I.

Sew. Mach. Stand Castings—Machined ready to run; 400 sets, very cheap. Hull & Belden Co., Danbury, Ct.

Wanted—The best Power Matching Machine in the market. Send circulars and capacity of machines to Melendy Bro's, Nashua, N. H.

Wanted—A first class Pattern Maker. H. B. Smith, Smithville, Burl. Co., N. J.

Single, Double, and Triple Tenoning Machines of superior construction. Martin Buck, Lebanon, N. H.

Gothic Furnace, for coal and wood, heats houses & churches. Send for book. A. M. Lesley, 226 W. 3rd St., N.Y.

Double-Entry Book-Keeping Simplified. The most successful Book on the subject ever published. Cloth, \$1. Boards, 75 cts. Sent post paid. Catalogue free. D. B. Waggoner & Co., 424 Walnut St., Philadelphia, Pa.

Main Driving Belts—Pat'd Improvement. Address for circular, Alexander Bro's, 412 N. 3d, Philadelphia, Pa.

Boulton's Paneling, Moulding and Dovetailing Machine is a complete success. Send for pamphlet and sample of work. B. C. Mach'g Co., Battle Creek, Mich.

For best and cheapest Surface Planers and Universal Wood Workers, address Bentel, Margedar & Co., Hamilton, Ohio.

Patent Scroll and Band Saws, best and cheapest in use. Cordesman, Egan & Co., Cincinnati, Ohio.

Small Engines. N. Twiss, New Haven, Conn.

Hotchkiss Air Spring Forge Hammer, best in the market. Prices low. D. Frisbie & Co., New Haven, Ct.

"Pantecot," or Universal Worker—Best combination of Lathe, Drill, Circular, and Scroll Saw. E. O. Chase, 7 Alling Street, Newark, N. J.

To Manufacturers—Pure Lubricating Oil, Sample Package (24 gals.), \$7. Send to Geo. Allen, Franklin, Pa.

Hotchkiss & Ball, Meriden, Conn., Foundrymen and workers of sheet metal. Fine Gray Iron Castings to order. Job work solicited.

For Sale—Second Hand Wood Working Machinery. D. J. Lattimore, 31st & Chestnut St., Phila., Pa.

Price only \$3.50.—The Tom Thumb Electric Telegraph. A compact working Telegraph Apparatus, for sending messages, making magnets, the electric light, giving alarms, and various other purposes. Can be put in operation by any lad. Includes battery, key, and wires. Neatly packed and sent to all parts of the world on receipt of price. F. C. Beach & Co., 346 Canal St., New York.

Peck's Patent Drop Press. Still the best in use. Address Milo Peck, New Haven, Conn.

All Fruit-can Tools, Ferracute Wks, Bridgeton, N.J.

American Metaline Co., 51 Warren St., N.Y. City. Genuine Concord Axes—Brown, Fisherville, N.H.

For Solid Emery Wheels and Machinery, send to the Union Stone Co., Boston, Mass., for circular.

Faught's Patent Round Braided Belting—The best thing out—Manufactured only by C. W. Army, 188 North 3d St., Philadelphia, Pa. Send for Circular.

Diamond Tools—J. Dickinson, 64 Nassau St., N.Y.

Magic Lanterns and Stereopticons of all sizes and prices. Views illustrating every subject for Parlor Amusement and Public Exhibitions. Pays well on small investments. 72 Page Catalogue free. McAllister 49 Nassau St., New York.

Temples and Oilcans. Draper, Hopedale, Mass.

Water, Gas, and Steam Goods—New Catalogue packed with first order of goods, or mailed on receipt of eight stamps. Bailey, Farrell & Co., Pittsburgh, Pa.

The "Scientific American" Office, New York, is fitted with the Miniature Electric Telegraph. By touching little buttons on the desks of the managers, signals are sent to persons in the various departments of the establishment. Cheap and effective. Splendid for shops, offices, dwellings. Works for any distance. Price \$6, with good battery. F. C. Beach & Co., 346 Canal St., New York, Makers. Send for free illustrated Catalogue.

For best Bolt Cutter, at greatly reduced prices, address H. B. Brown & Co., New Haven, Conn.

The Baxter Engine—A 48 Page Pamphlet, containing detailed drawings of all parts and full particulars, now ready, and will be mailed gratis. W. D. Russell, 18 Park Place, New York.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing Metals. E. Lyon, 470 Grand Street, New York.

Spinning Rings of a Superior Quality—Whitinsville Spinning Ring Co., Whitinsville, Mass.

Solid Emery Vulcanite Wheels—The Original Solid 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, 31 and 33 Park Row, New York.

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

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

Notes & Queries.

A. J. will find directions for stereotyping on p. 363, vol. 30.—J. T. can blue steel articles by the process given on p. 123, vol. 31.—J. K. will find an explanation of the theory of the crank on p. 112, vol. 31.—R. J. T. should consult a physician.—J. F. is informed that etching on glass is described on p. 409, vol. 31.

(1) W. B. G. asks: At what angle should mower knives be ground, so as to give the best and most desirable edge? A. It depends upon the material to be cut.

(2) W. K. says: Inasmuch as the question whether sparks of electricity can be discharged from the body of a workman in a powder mill, and cause an explosion, is agitating the mind of scientists, I send you an account of an incident which came under my observation a number of years ago. On a bitterly cold wintry day, a friend and myself started in a sleigh to make a visit. On retiring at night, my friend, after having removed an entirely woolen garment, threw it carelessly over his arm. Having laid it down, he approached the said garment with his other hand; and upon so doing, he was amazed to see an immense number of sparks all over the garment, as if it were on fire. This was accompanied with a noise similar to that produced by a voltaic battery. He withdrew his hand, and the sparks were gone, then reappplied it, and the same phenomenon was observed, in a less striking manner, however. Reapplying his hand for the third time, but a few sparks were seen, without any noise whatever. Where did the sparks proceed from? A. The sparks were caused by friction. They are often observed in removing woolen clothes in winter, especially when the air is very dry.

(3) R. B. B. asks: What would be the practical difference between cutting off steam at $\frac{1}{4}$ th stroke, and throttling the steam until just $\frac{1}{4}$ of the full working pressure is realized? A. To cut off the steam at $\frac{1}{4}$ th stroke would be the more economical, there being in that case less loss from condensation.

(4) A. M. asks: How can I produce a fine high color on gold jewelry? A. Boil 8 ozs. saltpeter, 4 ozs. alum, and 4 ozs. common salt together in a porcelain or other fireproof vessel (not metallic), in barely sufficient water to dissolve them; add 9 ozs. strong muriatic acid to this solution, and filter. This quantity will be sufficient for coloring 4 ozs. of work at a time, and should be kept in a well stoppered glass bottle when not in use. Another recipe is: Boil 10½ ozs. saltpeter and 5½ ozs. common salt together, in a porcelain dish, in a quantity of soft water barely sufficient to dissolve them, and $\frac{1}{2}$ oz. nitrate of silver (lunar caustic) and 9½ ozs. muriatic acid; filter. This quantity will be sufficient for coloring 4 ozs. of work at a time, and should be kept in a well stoppered glass bottle when not in use. To color with either of the foregoing mixtures, anneal the work twice, and boil it, each time after annealing, in a pickle consisting of 8 parts water and 1 part sulphuric acid. Then pour a sufficient quantity of the coloring mixture into a porcelain dish, and heat it to about 150° Fah. Hold the work in this for about two minutes, then take it out and rinse it in clean water. If not sufficiently colored to suit, repeat the process until the desired color is obtained. Another and more common method among jewelers is to make a kind of paste, consisting of 2 parts saltpeter and 1 part each of alum, sulphate of zinc, common salt, and a little water. These ingredients are well mixed in a mortar, and the articles to be colored are covered with the paste, laid upon an iron plate, and heated over a clear fire nearly to a black heat. They are then suddenly plunged into cold water and well washed. This insures a beautiful high color.

(5) F. H. D. asks: Will a locomotive, standing still on an up grade, move or start as easily up the grade when the crank is on a line from the axle to the point of the wheel which rests upon the rail as it would if the crank was at either side of this line? A. A locomotive should start equally well with one crank in any position, for if one is on the absolute dead center, the other is in a position to exert its maximum force.

(6) H. J. E. asks: 1. How much sulphuric acid must be put to a gallon of water to take the scale from castings that are to be used for stove patterns, and how long should they remain in the acid? A. About one of acid to fifteen to twenty of water. 2. What kind of a bath should the castings be put into after they are taken from the acid? A. Wash with clean water, and keep in a quantity of water containing a little potash or soda in solution until required. 3. How should wax be applied for waxing iron stove patterns? A. The wax is applied by simple friction with the metallic surfaces. This increases the temperature sufficiently to impart a fine even coating to the metal. 4. How can I make good varnish for wood patterns? A. Use shellac in alcohol. A little gum sandarac is sometimes added to this.

(7) W. B. M. asks: How can engraving tools be hardened? I am greatly annoyed by their breaking. A. Use Stubbs' steel, heat it to a low red heat, and temper to a straw color.

1. What is the best way to keep a boiler when not in use? I have one under my charge that is not used for several months in fall and winter. I generally run the water all out. Is that the best way to keep it? A. Yes. 2. I blow off a few inches at a time, never blowing out entirely when hot. A good many around here blow their boilers

out while hot, and this of course has a tendency to cake the slush, etc., held in solution, on the plates; at least that is my opinion. Am I not right? A. Yes.

(8) W. F. R. says: I claim that a powerful lamp for heating purposes will give off more heat to the room if a piece of sheet iron be placed horizontally just above it than if nothing be placed above it. My friend says there will be no difference. Which is right? A. The amount of heat given off by the lamp will be equal in both cases, but the metal would distribute the heat more evenly throughout the room.

(9) A. H. asks: How can I cement emery to cast iron? A. Coat the iron with white lead paint, mixed thickly; and when dry and hard, apply emery and glue.

(10) T. D. asks: How can I obtain the index of an engine lathe? I have applied to some machinists, and I purchased screw cutting tables; and although I can strike some threads, still I am unable to ascertain the proper method, as my gears all run differently from those described in any published system. My leading screw is an 8 thread; my gears are 28, 33, 35, 42, 49, 56, two 63's, 70, 77, 84, 91, 98, 105, 112. The gear on the spindle (under the head stock on cone) is 46. Can you give me any instructions in regard to filling out an index? A. Multiply the number of threads to the inch you wish to cut by any small number, for instance, 4, and this will give you the gear for the lead screw. Then multiply the number of threads to the inch in your lead screw by the same number (4), which will give you the gear wheel for the spindle. If the wheels thus obtained are sizes you have not got, try 2, 3, 5, or any other number as a multiplier.

(11) G. P. says: A rubber belt slips very much. Some people tell me to put rosin on it, and some say pitch. Will you give me your advice? A. Use a mixture of equal parts of red lead, French yellow, and litharge; mix with boiled linseed oil and japan sufficient to make it dry quickly.

(12) K. B. says: We recently cast a pair of brass boxes for the crank wrist of an engine of 100 horse power. The boxes were finished at the machine shop of the factory for which they were made. After the engine had run about 20 minutes the boxes became so hot that it was necessary to stop and cool them; and they continued to heat until we were obliged to remove them. The men condemn the boxes on the ground of being made of poor metal. The boxes were made in the proportion of 1 part block tin to 9 parts good scrap copper. Do you consider this a good material? If so, what was the probable cause of their heating? A. Your mixture of brass was a good one, though 1 part less copper would have been better. The heating may have occurred from the brasses not leading true, from the wrist not being true, from its having too little wearing surface, from the brasses bearing too much on the sides of the box, or from any one of a variety of similar causes.

(13) R. asks: 1. Where should I apply for a place on the school ship Minnesota? A. On board. 2. Will the authorities take a boy who is not a native? A. Yes.

(14) S. S. S. asks: What is the best treatment to give a Georgia pine floor, to make it non-absorbent of water and easily kept clean? A. Apply raw linseed oil, as follows: Take a block of wood, about 10 by 15 inches and 2 inches thick; tack woolen cloths upon it, saturate the cloths with the oil, and rub the floor till you produce a gloss.

What is the best paint for a smooth, hard-finished wall? A. Take best white lead and tone it down to a gray with a little black and yellow, using very little of the latter, so as to give only a slight tint off of the white. The first coats will sink into the wall, appearing spotted in places; repeat the coats until there is a uniform gloss throughout; this may take 4 or 5 coats.

(15) J. W. S. asks: How are twisted gun barrels made? A. After the square bars are made, they are twisted around a mandrel and then welded. See No. 1 of "Practical Mechanism."

(16) J. H. G. asks: 1. Will soft gray iron castings do for cores for electro-magnets? A. Yes. 2. Will they receive and discharge magnetism quick enough for cheap telegraph instruments? A. Yes. 3. Is Léclanché's battery a patent? A. Yes. 4. Which gives the best results with a given length of wire, a long slim coil or a short thick one? A. A thick wire with few convolutions gives the best effect when the amount of current passing through it is comparatively great. A thin wire with many convolutions is best when the current is small but has considerable electro-motive force. 5. Is a cone of hourglass shape, with broad poles, any better or as good as a straight one? A. Somewhat better for equal weights.

(17) E. C. H. asks: 1. In making the core box for the pattern of a steam cylinder, should it be made exactly the same size as the core prints, or is some allowance made for shrinkage? A. Green sand cores shrink, while dry cores expand a little. The amount is, however, in either case too small to render any allowance necessary. 2. Is cast steel melted and run into molds, as cast iron is, to produce the various articles of a steel difficult to form? A. Yes.

(18) J. M. S. asks: 1. Will No. 16 coppered wire do to construct a telegraph line $\frac{1}{2}$ a mile in length? A. Yes, but iron is better. 2. Which is the best, a ground or a return wire? A. A return wire. 3. How many more coils of battery will it take with the ground than the return wire? A. Three times. 4. Can a good ground be made by putting a bar of $\frac{1}{2}$ inch round iron in a hole 3x1x1, and then filling with scraps of old iron? A. Yes. This will be a pretty good one if the ground is wet.

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

W. B. B.—Your boiler deposit consists of lime alumina, oxide of iron, and oily matters.—B. B.—It is celluloid.

COMMUNICATIONS RECEIVED.

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

On a Feat in Saw-Making. By J. E. E.
On Large Safes. By S. H. R.
On Life-Saving Apparatus. By B. F.
On Copying Photographs. By J. C. C.
On Reaching the North Pole. By C. S.
On Fast Trains. By H. B. C.
On a Marine Governor. By P. A. H.
On Interstellar Space. By A. H. McK.
On Electric Motors. By H. M. P.
On the Locomotive. By F. G. W.
On the Psycho Mystery. By T. M. W.
On Mineral Wool. By A. D. E.
On Electric Force. By J. P.
On Terrestrial Magnetism. By N. S. W.

Also inquiries and answers from the following:

R. C.—J. C. B.—J. W.—P. S. A.—H. H. H.—M. S. J. J. A.—T. M. W.—H. P. G.

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.

Enquiries 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 air and gas engines? Who sells cheap ice machines? Who builds windmills? Where can native potash be obtained? Who sells pumps and water pipes made of glass? Who makes the best velocipedes? Who sells engine indicators? Who sells shadow pictures?" 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

November 2, 1875.

AND EACH BEARING THAT DATE.

(Those marked (r) are renewed patents.)

Air, de-aerating, L. K. Fuller.....	169,535
Arm pit shield, E. C. Bragg.....	169,535
Bale tie, C. H. Chase.....	169,531
Bale tie, R. Stewart.....	169,493
Baling short cut hay, C. Brown.....	169,515
Ball and socket joint, E. T. Starr.....	169,513
Barrels and kegs, head for, E. Foote.....	169,500
Basket, folding, G. Hammersley.....	169,398
Baskets, stove, H. C. Jones.....	169,446, 169,447, 169,448
Battery, galvanic, C. Duham.....	169,529
Bedstead, table, E. Kiss.....	169,534
Belt fastener, W. M. Chapman.....	169,416
Belting, uniting the ends of, C. C. Roe.....	169,482
Billiard chalk holder, J. Simonton.....	169,488
Bird cage book, Osborn & Drayton.....	169,571
Blind slat adjuster, G. Nichols.....	169,570
Boats, machine for framing, C. Bartlett.....	169,533
Bobbin, B. J. Hubbard.....	169,546
Boiler covering, F. B. Stevens.....	169,494
Boiler, feed, S. Olmstead.....	169,469
Boiler, steam, T. W. Godwin.....	169,492
Boiler, feed water heater, W. J. Austin.....	169,522
Books, fireproof covering for, E. W. Glover.....	169,528
Boot-nailing machine, W. Fitzgerald.....	169,479
Boot uppers and soles, uniting, McKay & Fairfield.....	169,467
Bottle stopper, A. Luthy.....	169,536
Bracket, adjustable, E. T. Starr.....	169,512
Brake, double acting air, H. L. Perrine.....	169,575
Brick machine, C. N. Fisher.....	169,428
Bridle bit for horses, Bellinger, Bolles & Fryer.....	169,430
Broom machine, mandrel, H. Anderson.....	169,519
Buckle, trace, M. T. Burke.....	169,513
Burial case, metallic, H. M. Gray.....	169,496
Burner, liquid fuel, G. H. Perkins.....	169,572
Burner lens attachment, M. C. Meigs.....	169,560
Button feeding device, Z. Gelinas.....	169,437
Cake making feeder, D. H. Lafferty.....	169,506
Can, oil, N. Peterson.....	169,576
Cane and umbrellas, J. Boyd.....	169,404
Cane and whip, O. H. Saxton.....	169,495
Car brake, S. G. Howe (r).....	6,721
Car brake, J. N. Sawkins.....	169,503
Car coach, T. H. Neal.....	169,569
Car coupling, A. Cyr.....	169,524
Car coupling, H. F. McKervey.....	169,563
Car wheel, W. H. Paige.....	169,570
Cars, gang for street, W. Guilfoyle.....	169,506
Carriage, curtain fixture, Knight & Hippie.....	169,505
Carriage top, R. F. Painter.....	169,571
Carriage top, Power & Anderson.....	169,579
Carriage umbrellas top, L. P. Tibbals.....	169,509
Cataract, cure of, J. W. Harvey.....	169,54
Chain links, bending, J. Baird.....	169,525
Chair seats, material for, D. H. Donovan.....	169,528
Chemist's test apparatus, C. Fahlberg.....	169,549
Cherry stoner, S. A. Darrach.....	169,525
Children enclosure for, H. J. Parker.....	169,471
Cigar pipe, R. L. Weed.....	169,501
Clothes dryer, G. A. Brooks.....	169,517
Clothes line reel, C. L. Hommedies.....	169,453
Clutch, B. F. Young.....	169,594
Cock, stop, H. G. Smeaton.....	169,489
Coffee roaster, F. Thomas.....	169,488

Comb, band, A. Poppenhusen.....	169,578
Cooking steamer, M. Pifer.....	169,579
Copy book, letter press, S. W. Soesbe.....	169,491
Cotton gin, W. S. Hoeder.....	169,384
Cotton scraper, B. L. McClung.....	169,462
Curtain fixture, F. Backofen.....	169,400
Curtain fixture, E. B. Lake.....	169,450
Cylinders, valve for steam, J. N. Lauder.....	169,452
Dental engine, S. D. Engle.....	169,345
Dental engine, W. W. Evans.....	169,346
Dental engine, E. P. Ryder.....	169,375
Dental engine hand piece, G. H. Cushing.....	169,342
Desk, school, T. Redmayne.....	169,478
Digger, potato, D. J. Roush.....	169,483
Door check, Breidenbach & Kuehnhofen.....	169,407
Door spring, J. M. Blood.....	169,405
Door spring attachment, W. M. Gray.....	169,351
Draftsman's ink saucer, F. Smith.....	169,387
Drawing board attachment, J. C. Hints.....	169,543
Drilling machine, tripod, J. B. Waring.....	169,389
Dropper, potato, Zane & Kennedy.....	169,395
Drying apparatus, T. Webber.....	169,500
Dye, W. H. Seaman.....	169,378
Earth-boring apparatus, Ruth & Crain.....	169,590
Earth-preserving compound, E. A. Snyder.....	169,593
Electricity, lighting by, Viosin & Dronier.....	169,387
End gate, E. G. Martin.....	169,461
Engine, rock-drilling, G. H. Reynolds.....	169,587
Engine, rotary, I. Van Kersen.....	169,603
Excelsior, making, L. H. Whitney.....	169,607
Exercising apparatus, J. B. Newbrough.....	169,467
Eyeletting machine, J. J. Allred.....	169,398
Faucet, measuring, F. C. Heiser (r).....	6,722
Fence, barbed wire, A. V. Wormley.....	169,390
Fence post support, H. McKenzie.....	169,562
Fence, wire, J. M. McClellan.....	169,369
Fertilizer distributor, W. H. Cook.....	169,523
Fire arm, breech-loading, C. E. Billings.....	169,335
Fire arm, breech loading, H. C. Bull.....	169,413
Fire blower, J. Held.....	169,385
Fire plug, C. F. Rapp.....	169,476
Fire shield, Moore & Bradley.....	169,466
Fires, extinguishing, H. Conant.....	169,422
Floor, refrigerating, Rochetot and Schmidt.....	169,481
Fluting iron, Fisher and Brown.....	169,334
Fluting machine, H. Albrecht.....	169,327
Fork, barley, S. Snell.....	169,594
Fork, hay, M. M. Cherry.....	169,417
Fort jar, C. R. Carter.....	169,340
Fruits, preserving, F. H. L. C. Sacc.....	169,591
Furnace, J. K. Caldwell.....	169,338
Furnace, hot air, S. E. Foster (r).....	6,722
Furnace, hydrocarbon, P. M. Qvist.....	169,523
Furnace, reverberatory, J. Price.....	169,531
Furnace, steam boiler, J. Enright.....	169,531
Furnace, steam boiler, J. A. Locke.....	169,455
Furnaces, pushing tube skips into, G. Matheson.....	169,460
Gas, lighting, Green and Barrow.....	169,332
Gas fitters' hooks, blank for, J. W. Lyon.....	169,564
Gas on air, etc., enriching, E. H. Covell.....	169,423
Gas, regulating flow of, Jacobsen and Murphy.....	169,549
Gasifier, drop light, J. Fox.....	169,430
Gate, J. A. Knepper.....	169,449
Gate latch, S. Cherry.....	169,418
Glass, decorating, J. Budd.....	169,412
Glass spheres, blowing, F. Rhind.....	169,479
Glove, gauntlet, Latcher and Dunham.....	169,351
Grain binder, S. S. Jackson.....	169,560
Grain decorticator, S. Dodson.....	169,426
Grain drill, feeding, A. J. Martin.....	169,561
Grain scouring, W. P. Robinson.....	169,589
Grate, J. A. Buckwalter.....	169,411
Gun stocks, recoil check for, W. D. Miller.....	169,465
Hame fastener, A. J. Park.....	169,572
Hand cuff, G. P. Houston.....	169,443
Hay, baling short cut, C. Brown.....	169,518
Hay rickling apparatus, J. B. Hill.....	169,542
Horse and water power, W. S. Watkins.....	169,391
Horse power, J. Smith.....	169,380
Horses in engine houses, releasing, C. Sbert.....	169,379
Horsehoe, S. Stone.....	169,485
Horsehoe nails, rolling, G. L. Hall.....	169,307
Hose pipe nozzle stand, O. Edwards.....	169,344
Hydrant, W. D. Greenelle.....	169,538
Induction apparatus, R. K. Boyle.....	169,514
Iron and steel from ore, producing, W. A. Lytle.....	169,560
Ironing board, W. M. Tobey.....	169,600
Jack, carrying, A. K. Norris.....	169,568
Knitting machine, C. J. Appleton.....	169,321
Knobs to spindles, attaching, C. Coleman.....	169,421
Lamp, F. A. Taber.....	169,497
Lamp extinguisher, Warren and Packard.....	169,604
Lantern, H. Beebe.....	169,511
Lantern, C. H. Lyman.....	169,457
Letter box and door bell, J. Lovenguth.....	169,358
Liquids, expressing, L. Brevet (r).....	6,721
Lock, door, C. L. Bates.....	169,401
Loom pattern chain, J. F. Wicks.....	169,508
Loom shedding mechanism, O. W. Kenison.....	169,552
Loom shuttles, D. Wright.....	169,504
Loom web stop mechanism, O. M. Stillman.....	169,596
Mail bag catcher, E. F. Hotchkiss.....	169,545
Mains, machine for tapping, J. Hancock.....	169,498
Match, safety, E. Haanel.....	169,509
Mattress and cushion, W. H. Horton.....	169,442
Meats, preservation of, F. H. L. C. Sacc.....	169,592
Mechanical movement, O. Child.....	169,34
Millstone-dressing machine, G. Heydrich.....	169,480
Molders' plates, operating, J. T. Peet.....	169,473
Mowing machine, A. G. Gray.....	169,435
Nets, manufacture of, J. H. Coevort.....	169,522
Oven, bakers', J. Bieder.....	169,404
Overhoe, J. I. Mellon (r).....	6,725
Packing, piston, G. H. Reynolds.....	169,596
Paint breaser, J. P. Hayes.....	169,439
Paper bag, C. Amazeen.....	169,399
Paper bag for brooms, E. D. Messinger.....	169,464
Paper box, F. Salomon.....	169,484
Paper collars, cutting, C. A. Brown.....	169,408
Paper perforating machine, J. S. Ives.....	169,548
Pattern chart, M. A. and L. A. Meicher.....	169,564
Pegging machine, leather screw, C. M. Higgins.....	169,541
Piano, upright, G. Trayer.....	169,396
Pinchers, crimpers', Wright and Hackett.....	169,503
Pipes, F. G. Merriam.....	169,565
Pipe, clear, R. L. Weed.....	169,501
Pipe drilling machine, F. Grinnell.....	169,354
Pipe, sprinkling, F. Grinnell.....	169,354
Pipe stem, J. W. Fleischmann.....	169,365
Pipe tongue, S. H. Dickerson.....	169,475
Pipes, drilling holes in, F. Grinnell.....	169,353
Planting machine primer, B. C. Chambers.....	169,520
Planter, check row, Klar and Dixon.....	169,361
Planter, corn, J. Bryer.....	169,499
Planter, corn, Gardner and Hayes.....	169,432
Flow, rotary gang, J. K. Underwood.....	169,499
Pocket book, D. K. Osbourn.....	169,470
Postal cards, filling, P. M. Hitchcock.....	169,441
Press, G. H. Reynolds.....	169,538
Printing press, oscillating, J. L. De Huff.....	169,526
Printing press, oscillating, W. C. Evans.....	169,527

Printing press, oscillating, Watson and De Huff.....	169,605
Pruning implement, Henkel and Ward.....	169,534
Railway, elevated, J. Westcott.....	169,600
Railway signal, F. Raymond.....	169,477
Railway signal, electric, E. E. Bean.....	169,509
Rain water cut-off, H. Wilkins.....	169,609
Rake, horse, W. Aldrich.....	169,329
Rake, horse hay, W. Aldrich.....	169,328
Ratchet movement, J. Parr.....	169,574
Roller for endless aprons, guide, J. Parr.....	169,573
Roofing composition, L. P. Teed.....	169,386
Row lock, F. D. Graves.....	169,537
Sad iron, O. Swift.....	169,496
Safe and vault door, M. Briggs.....	169,567
Safe, burglar-proof, E. R. Morse.....	169,567
Salesman's seat, S. D. Sollers.....	169,381
Salt and pepper box, G. H. Lomax.....	169,363
Sash fastener, I. H. Stoddard.....	169,494
Sash holder, Frost & Merrill.....	169,431
Saw buck, H. Diston.....	169,343
Saw-gumming machine, H. Baughman.....	169,508
Sawing machine, scroll, W. H. Kimball.....	169,553
Sawing machine, scroll, L. C. Pratt.....	169,475
Scale beam, E. A. Chameroy.....	169,415
Sealing device, hermetic, T. Roberts.....	169,480
Seeder lifting device, W. A. Van Brunt.....	169,602
Seeding machine, W. P. Penn (r).....	6,726
Sewing machine clamp, J. Dunn.....	169,530
Sifter, flour, Jintner, Weller, and Kellogg.....	169,454
Sink, L. Jones, Jr.....	169,531
Soap-boiling apparatus, M. J. Palmer.....	169,472
Spinning frame, J. E. Atwood.....	169,507
Spoke-tenoning machine, H. R. Carmany.....	169,414
Stove, G. W. Herrick (r).....	6,722
Stove, C. Warren.....	169,390
Stove grate, W. B. Hosford.....	169,544
Stove, heating, W. B. Treadwell.....	169,401
Stove, magazine, J. A. Buckwalter.....	169,410
Stove pipe drum, E. S. Blake (r).....	6,723
Swimming shoe, O. G. Ahlstrom.....	169,396
Syringe, shield, etc., E. T. Starr.....	169,384
Table leaf support, J. Wanner.....	169,388
Tailor's patterns, drafting, J. Bellamy.....	169,402
Tailor's pattern, J. H. Nichols.....	169,468
Telegraph, electric, R. K. Boyle.....	169,515
Telegraph, magnet-printing, G. L. Anders.....	169,506
Temperatures, regulating, A. Campbell.....	169,339
Tenoning machine, H. Brand.....	169,336
Testing machine, W. J. Scott.....	169,376
Thill coupling, T. J. Quick.....	169,582
Tobacco cutter, W. H. Pease (r).....	6,728
Tobacco in bags, packing, J. B. Farrar.....	169,533
Tool handle, J. W. Miller.....	169,367
Toy, automatic, Ives & Pilkington.....	169,547
Toy ball, bell metal, J. C. Clark.....	169,419
Toy gun and horn, L. Duval.....	169,427
Toy target, J. Poznanski.....	169,580
Transplanter, Johnson & Bowman.....	169,445
Truck, hand, J. Eugenebell.....	169,559
Valve, E. H. Beckwith.....	169,510
Vehicle spring, Corey & Neff.....	169,524
Venetian shade, C. Widemann.....	169,502
Ventilation of commodore, R. D. O. Smith.....	169,490
Vise, A. H. Brainard.....	169,516
Vise, A. O. H. P. Sehorn.....	169,486
Wagon box, T. Jennings.....	169,444
Wagon brake, H. Markrud.....	169,459
Warper, moulton, Damon, & Rice.....	169,468
Washing machine, T. Allen.....	169,397
Washing machine, A. Hale.....	169,437
Watch, J. K. Bigelow.....	169,512
Watch regulator, E. McNutt.....	169,458
Watchman's register, D. Shive.....	169,578
Water filter and purifier, A. Le Teller.....	169,562
Water meter, W. B. Mountney.....	169,568
Water-supplying apparatus, J. N. Poage.....	169,577
Water traps, manufacture of, G. W. Wicks.....	169,392
Weatherboard gage, R. J. Dodd.....	169,527
Weather strip, J. Cleave.....	169,430
Well packing, drive, V. F. Thomach.....	169,508
Whips, snapper loop for, H. H. Jones.....	169,550
Wrench, A. B. Lipsey.....	169,537
Yarn, etc., finishing, Rhodes et al.....	169,574
Yeast compound, J. Pfeiffer.....	169,474
Yoke, neck, C. Shuman.....	169,487

DESIGNS PATENTED.

8,764.—GLASSWARE.—H. Franz, Pittsburgh, Pa.	
8,765.—COFFIN PLATES.—C. B. Rogers, W. Meriden, Ct.	
8,766.—STOVES.—G. G. Wolfe et al., Troy, N. Y.	
8,767.—RANGES.—G. G. Wolfe et al., Troy, N. Y.	
8,768.—STOVES.—R. A. Cutler et al., Peoria, Ill.	
8,769.—STOVES.—G. G. Wolfe et al., Troy, N. Y.	

SCHEDULE OF PATENT FEE.

On each caveat.....	\$10
On each Trade mark.....	\$25
On filing each application for a Patent (17 years).....	\$15
On issuing each original Patent.....	\$30
On appeal to Examiners-in-Chief.....	\$10
On appeal to Commissioner of Patents.....	\$20
On application for Reissue.....	\$30
On filing a Disclaimer.....	\$10
On an application for Design (3 1/2 years).....	\$10
On application for Design (7 years).....	\$15
On application for Design (14 years).....	\$30

Advertisements.

Back Page.....	\$1.00 a line.
Inside Page.....	75 cents 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.

SECRETS WONDERS

And Mysteries. A 24 page Book, full of popular disclosures. Illustrated. Sent free to all for 3 postpaid stamps. Address J. FLETCHER & CO., Williamsburgh, New York

PORTABLE ENGINES FOR SALE. 2d hand, of 8 to 18 H.P. Rebuilt, Good as New. Also Stationary Engines and Boilers of all sizes. JAMES HILL & CO., Allegheny, Pa.

\$8 YOUNG AMERICAN SCROLL SAW. Send to J. M. BRUGLER, M'F'r, Williamsport, Pa.

NATIONAL TYPE WRITER prints a Letter quicker, plainer, and much easier than it can be written. It will make two copies at once, sets on the Table or Office Desk, occupies little room; just the thing for Merchants, Bookkeepers, Doctors, Lawyers, Mechanics, everybody. Price only \$25. ILLINOIS CENTRAL MANUFACTURING COMPANY, Clinton, Illinois.

SAFETY HOISTING
OTIS' Machinery.
OTIS, BROS. & CO.,
No. 348 BROADWAY, NEW YORK.

QUACKENBUSH'S AMATEUR

LATHE.



ATTENTION OF CAPITALISTS AND SCIENTIFIC MEN is invited to a model of Cowan's HEATING APPARATUS, now on Exhibition at 77 Union Square. By this wonderful invention, all and every description of Buildings can be heated Free of Cost. It is in practical operation in England, France, Russia, and recently in this country.

EMPLOYMENT.

I want 1,000 agents to canvass for the COMPLETE HERBALIST, and THE GROWING WORLD. I will give such terms and furnish such advertising facilities that no man need make less than \$200 per month and all expenses—no matter whether he ever canvassed before or not. Address Dr. O. PHELPS BROWN, No. 21 Grand Street, Jersey City, N. J., and full particulars will be sent by return mail.

THE "HARD TIMES" LIST.

How to Save Money.

A PAPER AND A MAGAZINE FOR LITTLE MORE THAN THE PRICE OF ONE.

Until Jan. 1, 1876, we will send THE TRIBUNE (WEEKLY \$2, SEMI-WEEKLY \$3), with either of the popular Magazines, at the following greatly reduced rates—for the cheapest ever offered by any paper:

	Regular Price.	With Weekly Tribune.	With Semi-Weekly Tribune.
Harper's Magazine.....	\$4 00	\$4 75	\$5 75
Harper's Weekly.....	4 00	4 75	5 75
Harper's Bazar.....	4 00	4 75	5 75
Scribner's Monthly.....	4 00	4 75	5 75
Atlantic Monthly.....	4 00	4 75	5 75
St. Nicholas.....	3 00	4 00	5 00
Scientific American.....	3 00	4 25	5 25
Christian Union.....	3 25	4 10	5 10

THE TRIBUNE cannot furnish specimen copies of these periodicals.

Address THE TRIBUNE, New-York.

ANY MANUFACTURER, who can supply machinery for the splitting of barley into two to six parts for each grain, the splitting to be done as much as possible in cubic parts without the formation of flour, is requested to address offers to H., 3434 b. d., care of the Advertising Agency of

HAASENSTEIN & VOGELER, at Leipzig (Germany).

PATENT FRICTION PULLEYS

Friction Clutch for V-Pulleys.

D. FRISBIE & CO., New Haven, Conn.

WANTED—Four sets of second-hand Card Machinery, in good condition; Cards from 24 to 30 ins. in width, Breakers from 36 to 42 ins. in width. Also Goddard Burr Picker. HOFFMAN & HOYT, Evening Post Building, New York City.

For SALE, CHEAP.

One No. 2 1/2 Ball's Planer & Matcher, not used 6 months. One No. 2 1/2 Wetherby, Rugg & Richardson Planer and Matcher, used same time. One No. 3 Ball's Planer and Matcher, used same time. One Daniel's Planer, 30 ins. wide, 18 ft. long, almost new. One No. 4 "Fitchburg" Drill, almost new. One Vreeland Iron Planer, planes 50 inches wide and 18 feet long, almost new. CHARLES PLACE, 103 Reade St., New York.

LeCount's Patent

MACHINIST'S TOOLS.

Set Iron Dogs.....	\$5.00
" Steel ".....	\$12.00
" ".....	\$6.00
" ".....	\$15.00

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.

BOOKWALTER ENGINE. Compact, Substantial, Economical, and Easily Managed. Guaranteed to work well and give full power claimed. Engine and Boiler complete, including Governor, Pump, &c., with shipping boxing, at the low price of 3 Horse Power.....\$250 00 4 1/2 ".....303 50 Put on Cars at Springfield, Ohio. Address JAS. LEFFEL & CO., Springfield, Ohio; or 109 Liberty St., New York City.

RAT. CHET DRILLS & WRENCHES. Drills \$5.00 to \$15.00 each. Send postal card for catalogue. LOWELL WRENCH CO., Worcester, Mass.

Hoosac Tunnel Machinery

FOR SALE.

Steam Engines and Boilers, Burlington Compressors and Rock Drills, Hoisting Machinery suitable for Mines Flange Pipe various sizes, from 15 to 3 inches dia., Cornish & Steam Pumps, one Contractor's Locomotive Lathes, Drills, Planers, and Bolt Cutters, Rubber Hose Drill Steel, &c. Address THOS. ROSS, Rutland, Vt.

THE CHRISTIAN UNION.

REV. HENRY WARD BEECHER, Editor.

Ellinwood's authorized verbatim reports each week of Mr. Beecher's

Sermons in Plymouth Church.

All his literary productions, including the characteristic "STAR PAPERS," will be given. Serial Stories by

REV. EDWARD EVERETT HALE, D.D., (Author of a "Man without a Country," &c.)

HON. ALBION W. TOURGEE, Judge of the Superior Court of North Carolina, (Author of "Tollette," &c.)

MRS. HARRIET BEECHER STOWE, (Author of "Uncle Tom's Cabin," &c.)

A Comprehensive Family Religious Newspaper. Terms \$3.20 per year, postage prepaid.

New and Unusual Terms to Agents.

Cash Commissions and Competitive Premiums in Cash.

\$2,000 Given Away!

Send for particulars.

HENRY M. CLEVELAND, Publisher. HORATIO C. KING, Asst. Publisher. 27 Park Place, New York.

E. M. MAYO'S PATENT BOLT CUTTER. Send for Illustrated Circular. Cincinnati, Ohio.

THE IMPROVED NIAGARA STEAM PUMP, 93 to 97 Pearl St., Brooklyn, N. Y. Agency at 40 John St., New York. Hubbard & Aller, SOLE MANUFACTURERS, ENGINES AND BOILERS, Pulleys, Shafting and Hangers a Specialty.

WHIPPLE'S Patent Door Knob.

Awarded a Bronze Medal at the American Institute Fair for 1874. The Judges say: "We consider this method of fastening DOOR KNOBS a great improvement over anything yet invented for the purpose, as it obviates the use of side screws and washers, and can be regulated to suit any thickness of Doors." Send for Circular.

WANTED—We desire in every city and county an agent for the exclusive sales of a staple article in the grocery line. Energetic men with little capital may make \$5,000 per annum. Address, with stamp, EUREKA MFG CO., 300 Washington St., New York.

CENTENNIAL DRILL CHUCK—Warranted perfect and durable. Holds 1-64 to 1-32 in. Sent by mail on receipt of price, \$1.25. Send for new reduced list of chucks. A. F. CUSHMAN, Hartford, Conn.

Machinery of Improved Styles for making SHINGLES, HEADING AND STAVES. Sole makers of the well known IMPROVED LAW'S PATENT SHINGLE AND HEADING SAWING MACHINE. For circulars, address THE VOR & CO., Lockport, N. Y.

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, 2nd and 3rd Avenues, Pittsburgh, Pa. 190 S. Canal Street, Chicago, Ill.

AGAIN—LAST SEASON our Agency business surpassed all others. It amounted to a quarter million of dollars. Many Agents laid up from two to three thousand dollars each, in a few months. The reason: new features, embracing several large additional profits unusual in this kind of work.

to the front with the best business for AGENTS

THIS SEASON the money-making chances are doubly improved! To show our good faith we guarantee Agents against all losses. Not one cent is risked. Be quick. Send two 3c. stamps for valuable specimens, liberal terms, &c. Address: THE LLOYD TRAVEL WEEKLY, New York, Boston, Chicago, or Atlanta, Ga.

NEW & SECOND HAND WOOD WORKING Machinery, Floorers, Planers and Matchers, Single and Double Surfaces, Moulding Machines, Scroll Saws, Suction and Blast Fans for Shavings, etc. D. J. LATTIMORE, 51st and Chestnut St., Philadelphia, Pa.

J.M. CARPENTER—MANUFACTURER OF FIRST CLASS TAPS, Pawtucket, R. I.

OPIUM AND MORPHINE HABIT CURED. THE ORIGINAL AND ONLY CURE PREPARED. Send stamp for book on Opium-eating, to W. B. SQUIRE, M.D., Worthington, Greene Co., Ind.

DECALCOMANIE, or TRANSFER PICTURES, with book of 24 pp., giving full instructions in this new and beautiful art, sent post-paid for 15 cts. 100 sets in pictures, 10 cts. They are Birds, Landscapes, Animals, Birds, Insects, Flowers, Autumn Leaves, Comic Figures, &c. They can be easily transferred to any article so as to imitate the most beautiful painting. Also, a beautiful GEM CHROMOS for 10 cts. 1 set for 50 cts. Agents wanted. Address J. L. PATTEN & CO., 82 William Street, New York.

DRAWING INSTRUMENTS—DRAWING Materials, Surveying Compasses, Transits, Levels, Tape Measures, Field Glasses, Spy Glasses, Microscopes, Telescopes, Barometers, &c., &c. JAMES W. QUEEN & CO., 221 Chestnut Street, Philadelphia, Pa. 801 Broadway, New York.

Catalogues, Part 1st, MATHEMATICAL; Part 2d, OPTICAL; Part 3d, MAGIC LANTERNS; Part 4th, PHILOSOPHICAL INSTRUMENTS, each ten cents.

PATENT DOUBLE ECCENTRIC CORNICER BRAKE—Manufactured by THOMAS & ROBINSON, Cincinnati, O. Send for Circulars.

FOR SALE—The right for the simplest, cheapest, and best Steam Pump in the world. Address J. S. FOSTER, Salem, Mass.

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

CEMENT PIPE MACHINERY. Four years' litigation decided in favor of the Stockwell Patents. Territory for sale or to lease in the United States and Canada, by J. W. STOCKWELL & CO., Portland, Me., U. S. A.

FINE MACHINISTS' & AMATEUR TOOLS. Foot Lathes, Planing Lathes, Centennial Grind Stones, Taps, Dies, Drills, Automatic Boring Tool, Fleetwood Scroll Saws. Send 6 cents in Stamps for Complete Illustrated Catalogue. JACKSON & TYLER, 16 German Street, Baltimore, Md.

FINE TOOLS For Machinists, Jewelers, Engravers, Watchmakers, Amateurs, and others. Also, a fine assortment of File and Steel Wire Supplies, at FRASSE & CO.'S, 63 Chatham Street, New York.

PATENT Planing and Matching and Molding Machines, Gray and Wood's Planers, Self-oiling Saw Arbors, and other wood-working machinery. S. A. WOOD'S MACHINE CO., 191 Liberty St., N. Y. Send for Circulars, etc. 16 Sudbury St., Boston.

PATENT WOOD WORKING MACHINERY PLANING & MATCHING, MOULDING, MORTISING, TENONING, RESAWING, SHAPING BAND & SCROLL SAWS &c. &c. J.A. FAY & CO. CINCINNATI, O.

THE Scientific American SUPPLEMENT. 1876

\$5 a year by mail, post-paid. Send 10 cents for Specimen Copy.

TO ILLUSTRATE AND DESCRIBE the many interesting themes and objects presented in the GREAT CENTENNIAL INTERNATIONAL EXPOSITION OF 1876, and also to meet the wants of that large class of readers who desire an increased supply of Scientific Information, particularly of the more Technical and Detailed character, we shall issue a SPECIAL PUBLICATION, entitled the SCIENTIFIC AMERICAN SUPPLEMENT, to be printed weekly during the Centennial year of 1876, and, perhaps, permanently thereafter. Each number will have sixteen large quarto pages, issued weekly, printed in the best style, uniform with the SCIENTIFIC AMERICAN, but separately paged.

The SCIENTIFIC AMERICAN SUPPLEMENT, in addition to the special matter pertaining to the International Exposition, will embrace a very wide range of contents, covering the most recent and valuable papers by eminent writers in ALL THE PRINCIPAL DEPARTMENTS OF SCIENCE AND USEFUL KNOWLEDGE, to wit:

- 1.—**Chemistry and Metallurgy.**—Embracing New Chemical Discoveries, Improvements, and Processes, with engravings, New Processes of Working Iron, Steel, Lead, Copper, Gold, Silver, and the Various Metals, with engravings of New Apparatus, New Information, etc.
- 2.—**Mechanics and Engineering.**—The latest and best papers upon Steam Engineering, Railway Engineering, Mining, and Civil Engineering, Mill Work, Textile Industry, with engravings and working drawings.
- 3.—**Electricity, Light, Heat, Sound.**—Latest Improvements in Telegraphy, Telegraph Engineering, Improvements in Galvanic Batteries, Electric Engines, New and Useful applications of Electricity in the Arts, with engravings.
- 4.—**Architecture.**—Examples of the best New Structures, with details and drawings.

Address MUNN & CO., Publishers, 37 Park Row, New York.

\$5 to \$20 per day at home. Samples worth \$1 free. STINSON & CO., Portland, Maine.

The TOLL-GATE! Prize Picture sent free! An ingenious gem! 50 objects to send! Address with stamp, E. C. ABBEY, Buffalo, N. Y.

Brainerd Milling Machines all styles and sizes. A new Universal Milling Machine for \$30. Also Brown's Pat. SCREW MACHINES, and our new Brainerd STEEL BAR VISE. B. M. M. CO., 131 Milk St., Boston, Mass.

STONE SAWING MACHINERY. MERRIMAN'S PATENT. ALSO, HAND AND STEAM DERRICKS & TRAVELLERS, THOMAS FASS, RUTLAND, VT.

Model Steam Engines, FROM 20 CTS. UPWARDS, FROM GEORGE PARR'S UNEQUALLED MODELS OF Vertical Engines, Paddle Engines, Steam Hammers, Locomotive Engines, Steam Boilers, Marine Screw Engines, Steam Engines, Water Motor Engines, Fire Engines, Miniature Machine Shop, Miniature Mechanical and Comical Figures and saw Mills run by above appliances. Also, Celebrated Amateur's Lathes. Tools and Fittings of every description. Inimitable Castings, for \$1.00 per set and upwards, by means of which numbers of the above Steam Engines, Lathes, &c., have been successfully made by Amateurs. Thousands prove the unparalleled success of the above models and castings. For full description and prices of the above, together with the requisite tools, see "Parr's Technical Guide," 8vo, Eighth edition, Sixty-fifth thousand, over 150 pages, with nearly 600 splendid illustrations, giving full instructions in Sorrento Free Carving, and Scroll Sawing, and 150 Parlor Experiments in Chemistry, the wonders of Microscopy, the beauties of Model Telegraphy, together with other useful and scientific information; also all necessary instructions how to buy, how to use, and how to make model engines. Post free, 30 cents. Address GEO. PARR, Manufacturer of Mechanics' Tools, Buffalo, N. Y.

CLARK & COMPANY'S PATENT SELF-COILING, REVOLVING STEEL SHUTTERS Can be readily fitted to Store Fronts, Rear Windows or other openings, making them FIRE AND BURGLAR PROOF, and affording absolute protection; also, WOOD SHUTTERS in various kinds of wood, suitable for Store Fronts, Private Houses, Offices, and School Partitions. Clark's shutters are self-acting, require no machinery or balance weights, and cannot get out of order. They are handsome in appearance, and are the best and cheapest shutters in the world. Are fitted to the new Tribune Building, Delaware and Hudson Canal Building, Manhattan Building, Lenox Library Building. Have been for years in daily use in every principal city throughout Europe, and are endorsed by the leading architects of the world. JAMES G. WILSON, Manager, 215 West 26th St., New York, and at London, Paris, Vienna, Berlin, Melbourne, &c., &c.

AGENTS WANTED.

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

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

5.—**Technology.**—New and Useful Inventions and Discoveries relating to THE ARTS: Improvements in Photography, Printing, New Implements, New Machinery, New Processes, New Recipes, Improvements pertaining to Textile Industry, Weaving, Dyeing, Coloring, New Industrial Products, Animal, Vegetable, and Mineral—with engravings.

6.—**Agriculture, Botany, and Horticulture.**—New and Useful Information in all branches of Agriculture. Descriptions of New Plants, Trees, Shrubs, and Flowers, New, Useful, and Interesting Facts in relation to Cultivation, Propagation, with engravings.

7.—**Rural and Household Economy.**—The Latest Information concerning Building Materials, New and Valuable Recipes, and a great variety of Miscellaneous Information pertaining to Rural and Household affairs—with engravings.

8.—**Medicine, Hygiene, Therapeutics.**—Exhibiting the progress of Medical Science in various branches; New Medicinal preparations, New Health Appliances, and much interesting information.

9.—**Natural History and Zoology.**—The Latest Investigations, Discoveries, and most interesting information in this department of Science.

10 & 11.—**Meteorology, Terrestrial Physics, Geography.**—Accounts of Interesting Atmospheric and Terrestrial Phenomena, Travels, Explorations and Discoveries, etc.

12.—**Geology and Mineralogy.**—The Latest and most interesting Geological Investigations and Reports, and New Discoveries.

13.—**Astronomy.**—Recent Interesting Discoveries and Information, with Reports of Astronomical Phenomena, Progress, New Instruments, etc.

TERMS:—Scientific American Supplement, One year, post-paid, \$5.00; half year, \$2.50; three months, \$1.25. Three copies, one year, \$15.00; five copies, \$20.00; ten copies, \$35.00. One copy of SCIENTIFIC AMERICAN and one copy of SCIENTIFIC AMERICAN SUPPLEMENT, one year, post-paid, \$7.00.

Address MUNN & CO., Publishers, 37 Park Row, New York.

Amateur Workers in FANCY WOODS

Can be supplied with the following HARD and RARE WOODS, planed ready for use: 3-16, 1-4, 1-2 inch and upward. Cash to accompany orders. Rosewood, Satinwood, Holly, Walnut, Mahogany, Ebony, Red and White Cedar, Bird's-eye Maple, &c.

Geo. W. Read & Co., 186 to 200 Lewis St., foot of 5th & 6th Sts., E. R. N. Y.

Orders by mail will have prompt and careful attention. Inclose stamp for Catalogue and Price-List.

WASHINGTON, D. C., Sept. 15, 1875.

JNO. MATHER, Treas. Valley Machine Co., East Hampton, Mass. Dear Sir: The "Wright Bucket Plunger Steam Pump" you built for the Government "works like a top." Am sure it has never had its equal in any of the Departments, and I have no hesitancy in recommending this Pump to any one in want of a first-class, noiseless Steam Pump. Very respectfully, J. THOS. MILLER, Chief Engineer U. S. House of Representatives. Send to us for catalogue. V. M. COMPANY.

The Myers Portable Engine, 1.5, 3, 5, 8 h.p. Something new. Best for price. Circulars, SECOND-HAND IRON MACHINERY, AND WOOD WORKING MACHINERY. CHAS. PLACE, 103 Reade Street, New York.

8,000 in Use Blake's STEAM PUMPS for every possible duty. Send for Illustrated Catalogue. GEO. F. BLAKE MFG CO., 36 & 38 Liberty Street, New York.

Cor. Causeway and Friend Sts., Boston, Mass. 50 and 52 South Canal St., Chicago, Ill.

OUR SPECIALTY STEAM PUMPS AND BOILER FEEDERS. SEND FOR ILLUSTRATED CATALOGUE. COPE & MAXWELL MFG CO., HAMILTON, OHIO.

TO ENGINEERS, MACHINERY MANUFACTURERS, TOOL MAKERS, PATENTERS AND OTHERS.—The undersigned influential and well established firm, carrying on business in Melbourne, the principal of which has had over 30 years' experience in the Australian Colonies, and which has a large and extended connection, is willing to undertake the sole agency in the above Colonies for the sale of all classes of Engines, Agricultural Machinery, Engineers' Tools, Mechanical Inventions and Patents, and also to transmit every description of business in this class. Highest references given. DAVID MUNRO & CO., 151 Queen Street, Melbourne.

STEAM PUMPS.

FIRST PRIZES, VIENNA, PARIS, NEW YORK, BALTIMORE, BOSTON. Send for circular of recent patented improvements. THE NORWALK IRON WORKS, South Norwalk, Conn.

VOLNEY W. MASON & CO., Manufacturers of PAT. FRICTION PULLEYS, FRICTION CLUTCHES for connecting Shafting and Gearing, HOISTING MACHINERY AND ELEVATORS. PROVIDENCE, R. I.

NEW METHOD OF ENGRAVING Most Perfect. Photo Engraving Co. 62 Courtlandt St. New York.

Relief Plates for Book, Newspaper, Catalogue and Circular Illustrations Cheaper than Wood Cuts. The Scientific American uses our plates. Send stamp for Illustrated Circular.

IMPROVED MACHINERY for STAVE Heading, Shingle and Handles, Cabinet Maker's Machinery, Bailey Gauge Lathe, Durkee's Automatic Saw Mill (Improved), Key Seat Cutting, Pulley Boring and Milling Machines, Radial Drills, Steam Engines, and Bailey's Veneering Machines, Cable and Sheaves for transmitting Power &c. &c. T. R. BAILEY & VAIL, Lockport, N. Y.

VINEGAR HOW MADE IN Cider, Wine or Molasses, without using drugs. Address F. L. SAGE, Vinegar Maker, Springfield, Mass.

Do Your Own Printing! Press for cards, labels, envelopes, etc. Larger sizes for larger work. Business Men do their printing and advertising, save money and increase trade. Finest and profit in Amateur Printing. The Gilt or Silver Presses have great fun and make money fast at Springing. Send two stamps for full catalogue of presses, type, etc., to the Manufacturers, KELLEY & CO., Meriden, Conn.

WILLIAM HENRY KING—ALBUMEN MANUFACTURER, 75 & 80 St. Andrew Street, Liverpool, Eng.

MACHINERY

IRON & WOOD WORKING MACHINERY OF EVERY DESCRIPTION.

Cold Rolled Shafting. HANGERS, PULLEYS, COUPLINGS, BELTING, &c. Send for Illustrated Catalogue and Price List.

GEORGE PLACE, 121 Chambers & 103 Reade Sts., N. Y. City.

BLAKE'S PATENT Stone and Ore Breaker Crushes all hard and brittle substances to any required size. Also, any kind of STONE for ROADS and for CONCRETE, &c. Address BLAKE CRUSHER CO., New Haven, Conn.

Munn & Co.'s Patent Offices.

Established 1846.

The Oldest Agency for Soliciting Patents in the United States.

TWENTY-EIGHT 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 draftsmen 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 Streets, Washington. They also prepare and file caveats, procure design patents, trademarks, and reissues, 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 in fact attend to every branch of patent business both in this and in foreign countries.

Patents obtained in Canada, England, France, Belgium, Germany, Russia, Prussia, Spain, Portugal, the British Colonies, and all other countries where patents are granted.

Copies of Patents.

Persons desiring any patent issued from 1866 to November 26, 1867, can be supplied with official copies at a 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 1866 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 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.

A pamphlet of 110 pages, containing the laws and full directions for obtaining United States patents, also a circular pertaining exclusively to Foreign Patents, stating costs in each country, time granted, etc., sent free. Address

MUNN & CO., Publishers SCIENTIFIC AMERICAN; 37 Park Row, N. Y. BRANCH OFFICE—Corner F and 7th Streets, Washington, D. C.

Advertisements.

Back Page - - - - - \$1.00 a line.
Inside Page - - - - - 75 cents 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.

Engine, Spindle, & Cylinder Oil. F. H. KELLOGG, 15 Cedar St., N. Y. Manufactures the best. Established '78.

NO FILES ARE USED ON ROE'S CHISEL TOOTH SAWS. No sawing, no gumming, no rounding, nor side set to perplex the sawyer. They run straight, and are fifty per cent cheaper to use than the old saw.

Diamond Solid Emery Wheels.

Prices—6x4, \$1.35; 8x4, \$2.25; 12x4, \$3.50; 16x4, \$5.50; 18x2, \$10.00; 20x2, \$15.00; 24x2, \$22. All other sizes at proportionate prices. Fast cutting, free from glazing, they are the best Solid Emery Wheels. Give diam. of holes in your order for wheels. Emery Grinders unequalled by any in the world. Address AMERICAN TWIST DRILL CO., Woonsocket, R. I.

GLASS OIL CUPS

of all kinds. Brass Fittings for Steam, Water and Gas. Brass Castings. Send for Catalogue. HILLARD & HOLLAND 62 Gold St., New York.

HAMILTON RUBBER WORKS, Trenton, N. J. Manufacturers of Hose, Belting, Packing, Car Springs, and Rubber for mechanical purposes.

MAGNETS—Permanent Steel Magnets of any form or size, made to order by F. C. BRACE & CO., 346 Canal St., New York. Makers of the celebrated Tom Thumb and Miniature Telegraph Instruments.

RICHARDSON, MERIAM & CO., Manufacturers of the latest improved Patent Daniels' and Woodworth Planing Machines, Matching, Sash and Molding, Tenoning, Mortising, Boring, Shaping, Vertical and Circular Re-sawing Machines, Saw Mills, Saw Arbors, Scroll Saws, Railway, Cut-Off, and Rip-saw Machines, Spoke and Wood Turning Lathes, and various other kinds of Wood working Machinery. Catalogues and price lists sent on application. Manufacturers, Worcester, Mass. Warehouse, 107 Liberty Street, New York.

Shaping Machines
Have novel device for changing length of stroke while in motion, also, automatic down feed, and quick return. Four sizes. Patented 1868, 1871, 1874.
Wood & Light Machine Co.
Worcester, Mass.
Manufacturers of all kinds of Iron Working Machinery. Shafting, Pulleys, &c.

Just Out.

WRINKLES AND RECIPES,

COMPILED FROM THE
Scientific American

An Illustrated Hand-Book of Practical Hints and Suggestions for Mechanics, Engineers, Farmers, Housekeepers, and Workmen generally.

EDITED BY PARK BENJAMIN.

Contents.

DEPARTMENT OF MECHANICS.
Master-Tools, accurately represented. How to make and use them. Valuable suggestions for management of Machine Tools. Hints for Casting, Forging, Tempering, etc. Trade Secrets and Wrinkles. The whole supervised by JOSHUA REE.

DEPARTMENT OF ENGINEERING.
The management, construction, and repair of Boilers, Engines, Valves, Shafts, Belts, Pulleys, and Hangers. Brief rules for practice, etc., prepared by Mr. B. H. BULL. Also, New Paper on Testing Metal, expressly written by Prof. B. H. THURSTON, C.E., who also supervises the entire Department.

DEPARTMENT OF PRACTICAL TECHNOLOGY.
Supervised by Prof. F. H. VANDER WEYDE, M.D. Metallurgical Operations; Cements and Glues; Painting and Varnishing; Making simple Instruments, etc., etc. Hundreds of Recipes for every variety of Industrial Work.

DEPARTMENT OF THE FARM.
How to construct Farm Buildings. The Dairy. Hints for care of Stock, about Manures, Plants, Vegetables, Trees, Farm Machinery, etc., etc.

DEPARTMENT OF THE HOUSEHOLD.
Cleaning Processes of all kinds. Window Gardens. Destruction of Vermin. Care of China, Glass, and Furniture. Papering Walls. Simple Remedies, etc., etc. The volume comprises 350 pages, is printed on fine paper, with gilt edges, and is of large pocket-book form, flexible covers, neatly ornamented.

Mailed, post paid, on receipt of \$1.50.
1 copy Scientific American, 1 year, and 1 copy Wrinkles and Recipes.....\$1.20
Address

H. N. MUNN,

PUBLISHER,
F. O. BOX 72,
37 Park Row, New York City.

Geo. L. Burr,

Successor to FREEMAN & BURR.

This old and popular establishment opens the season with an unparalleled stock, to which the attention of purchasers is cordially invited.

OVERCOATS, SUITS, BOYS' SUITS,
OVERCOATS, \$5 to \$40. SUITS, \$10 to \$50. BOYS' SUITS, \$5 to \$20.
OVERCOATS, SUITS, BOYS' SUITS,

Orders by Mail.

ORDERS by Letter promptly filled. GEO. L. BURR'S System, for supplying PATRONS at a distance, which consists of furnishing Rules for Self-Measure, Samples of Goods, Prices, Book of Fashions, etc., FREE on application, enables parties in all parts of the country to order, with the certainty of receiving the most Perfect Fit attainable.

For showing Heat of
Pyrometers, Ovens, Hot Blast Pipes, Boiler tubes, Super-Heated Steam, Oil Stills, &c.
HENRY W. BULKLEY, Sole Manufacturer,
96 Liberty St., New York.

IRON PYRITES,
free from Arsenic, in quantities, cheap. Box 30, Brockville, Ont.

ENGINES & BOILERS, new & 2d h'd., perfect condition. Very cheap. Address BINGHAM & RICH, Oil City, Pa.

THE NATIONAL Steel Tube Cleaner.

Adopted and in use by U. S. Navy. For sale by dealers. Send for Circular. THE CHALMERS SPENCER CO., foot E. 9th Street, N. Y. Agents for the U. S.

NON-COMBUSTIBLE STEAM BOILER & PIPE COVERING

"WITH AIR SPACE IMPROVEMENT."
Saves 10 to 20 per cent. CHALMERS SPENCER CO., foot E. 9th St., N. Y.; 1202 N. 2nd St., St. Louis, Mo.

100 page Book and samples of Rubber Roofing. Complete materials for new roof, 4½ c. a ft. Fire-proof, durable, cheap. Easily applied with positive satisfaction. Write at once and save money. N. Y. Slate Roofing Co., CEDAR ST., N. Y.

FREE
State where you saw this notice.

MILLER, METCALF & PARKIN,
Successors to M. B. & P.

In the Manufacture of the well-known Brand of CRESCENT STEEL.
To maintain the character and standing of this brand, a full supply of the best steel irons known has been secured, and consumers can rely on uniformity and excellence. Especial attention is paid to the manufacture of fine tool and die steel; also cast spring, machinery and planished clock spring steel.
Represented in the Eastern States by
ELY & WILLIAMS, 1232 Market St., Philadelphia, and 93 Liberty St., N. Y.

THE SOUTHERN STATES AGRICULTURAL AND INDUSTRIAL EXPOSITION

Will be held on the Fair Grounds, at New Orleans, commencing February 26, 1876, and continuing Ten Days.
L. N. MARKS, PRESIDENT.
SAMUEL MULLEN, GENERAL SUPERINTENDENT.
Executive Committee.

A. BALDWIN, Chairman;
JAMES I. DAY, W. B. SCHMIDT,
COLONEL J. D. HILL, JOHN G. FLEMING.

It is the aim of the Board of Commissioners to make it a thorough Exposition of the Agricultural and Mechanical Products of the Southern States, Mexico, and Central America; but it will be open to competitors throughout the country, and the general premium list will embrace all articles comprehended in the general design of an Agricultural and Industrial Exposition, including special premiums for strictly Southern products.

The Mechanical Department has been devised with great care and on the most extensive scale. The Premium List will be ready for distribution November 20th. Ample arrangements have been perfected for the transportation of goods and visitors from every section at reduced rates. For detailed information, address
SAMUEL MULLEN, GEN'L SUP'Y,
No. 50 Camp St., New Orleans.

DAMPER BEST AND LEVER
REGULATORS GAGE COCKS.
MURRILL & KEIZER, 44 Holliday St., Balt.

IRON PLANERS.
ENGINE LATHES, DRILLS, &c. Send for Price List.
NEW HAVEN MANUFACTURING CO.,
New Haven, Conn.

PORTLAND CEMENT.
From the best London Manufacturers. For sale by JAMES BRAND, 55 CHURCH ST., N. Y.
A Practical Treatise on Cement furnished for 25 cents.

IRON AND STEEL DROP FORGING.
Of Every Description, at Reasonable Prices.
The Hull & Belden Company, Danbury, Ct.

PORTLAND CEMENT
For Walks, Cisterns, Foundations, Stables, Cellars, Bridges, Reservoirs, etc.
Remit 6 cents postage for Practical Treatise on Cements.
S. L. MERCHANT & CO., 76 South St., New York.

THOMAS'S FLUID TANNATE OF SODA
Never fails to remove Scale from any Steam Boiler, using any kind of water. It is in Barrels 500 lb., ¼ Bbls. 250 lb., ¼ Bbls. 125 lb. Price only 10c. per lb. Address
N. SPENCER THOMAS, Elmira, N. Y.

BOGARDUS' PATENT UNIVERSAL ECCENTRIC MILLS—For grinding Bones, Ores, Sand, Oil Crutches, Fire Clay, Guano, Oil Cake, Feed, Corn, Cobs and Cob, Tobacco, Snuff, Sugar, Salts, Roots, Spice, Coffee, Coconut, Flaxseed, Asbestos, Mica, etc., and whatever cannot be ground by other mills. Also for Paints, Printers' Inks, Paste Blacking, etc. JOHN W. THOMAS, successor to JAMES BOGARDUS, corner of White and Elm Sts., New York.

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.

MERCHANT CLOTHIER, WAREHOUSES:
138 & 140 FULTON STREET, NEW YORK.
[ESTABLISHED 1852.]

Schlenker's Stationary

Revolving - Die Bolt Cutters,
MANUFACTURED BY THE
HOWARD IRON WORKS,
BUFFALO, N. Y.

Send for Circular.

HARTFORD

STEAM BOILER

Inspection & Insurance

COMPANY.

W. B. FRANKLIN, V. Pres't J. M. ALLEN, Pres't.
J. R. PIERCE, Sec'y.

HARTFORD, CONN.

DITCHING and EXCAVATION.
RANDOLPH'S DITCHER and EXCAVATOR: Simple strong, and adapted to all soils reasonably free from stumps or large stones. Will do the labor of 50 men steadily, at the cost of ten. Machines of all sizes, cutting from three inches wide, three feet deep, to 36 inches wide, four feet deep. Extra sizes made to order. Circulars, &c., sent on application to
RANDOLPH BROS., 111 Broadway, New York.

T. V. Carpenter, Advertising Agent. Address Box 72, New York City.

Todd & Rafferty Machine Co.

MANUFACTURERS OF
The celebrated Greene Variable Cut-Off Engine; Lowe's Patent Tubular and Flue Boilers; Plain Slide Valve Stationary, Horizontal, and Portable Engines. Boilers of all kinds. Steam Pumps, Mill Gearing, Shafting, &c., 80½ Tow Oakum, Rapping, Rope, Flax, and Hemp Machinery. Agents for the New Haven Manufacturing Co.'s Machine; let's Tools; for Judson's Governors and Stop-Valves; Sturtevant Blowers; and Differential Pulley-Blocks. WAREHOUSES, 10 HARTLEY STREET, NEW YORK. WORKS PATERSON, NEW JERSEY.

SCIENCE RECORD For 1876.

SCIENCE RECORD is a splendid book of 600 pages, published annually, about the 15th of January. Illustrated with many engravings. Price \$2.50.

THE Volume for 1876 will be published about January 15th. Its contents will embrace the most interesting Facts and Discoveries in the various Arts and Sciences that have transpired during the preceding year, exhibiting in one view the General Progress of the World in the following Departments:

CHEMISTRY AND METALLURGY, MECHANICS AND ENGINEERING, ELECTRICITY, LIGHT, HEAT, SOUND, TECHNOLOGY, THE USEFUL ARTS, BOTANY 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.

Every person who desires to be well informed concerning the Progress of the Arts and Sciences should have a copy of SCIENCE RECORD for 1876. It will be a most interesting and valuable book, and should have a place in every Household and Library.

600 pages Octavo. Handsomely Bound. Many Engravings. Price \$2.50. Sent, post-paid, on receipt of price.

All the preceding volumes of SCIENCE RECORD may be had separately at \$2.50 each, or \$10 for the five volumes, 1872, 1873, 1874, 1875, and 1876.

MUNN & CO., PUBLISHERS,
37 Park Row,
New York City

THE SCIENTIFIC AMERICAN

For 1876.

The Most Popular Scientific Paper in the World.

THIRTY-FIRST YEAR.

Only \$3.20 a year including Postage.

Send 10 cents for Specimen copy

THE SCIENTIFIC AMERICAN, now in its 31st year, enjoys the widest circulation of any weekly newspaper of the kind in the world. A new volume commences January 1, 1876. Published weekly. Now is the time to subscribe and to form clubs.

THE CONTENTS OF THE SCIENTIFIC AMERICAN embrace the latest and most interesting information pertaining to the Industrial, Mechanical, and Scientific progress of the world; Descriptions, with beautiful Engravings, of New Inventions, New Implements, New Processes, and Improved Industries of all kinds; Useful Notes, Recipes, Suggestions and Advice, by Practical Writers, for Workmen and Employers, in all the various arts.

EVERY NUMBER contains sixteen large quarto pages, elegantly printed and illustrated with many engravings. The year's issue contains 832 large pages, equal to four thousand book pages, at a cost, including postage, of only \$3.20 a year to the subscriber.

THE SCIENTIFIC AMERICAN will be especially enriched during the current year by splendid engravings and descriptions of the most noticeable objects in the great Centennial International Exhibition.

Engineers, Mechanics, Telegraphers, Inventors, Manufacturers, Chemists, Photographers, Physicians, Lawyers, Clergymen, Teachers, and People of all Professions, will find the SCIENTIFIC AMERICAN most useful and valuable. Its pages teem with interesting subjects for thought, study, and conversation, and are an unfailing source of new and instructive information. As an Instructor and Educator, the SCIENTIFIC AMERICAN has no equal. It is promotive of knowledge and progress in every community where it circulates. It should have a prominent place in every Household, Reading-Room, and Library.

Specimen copies sent, prepaid, on receipt of 10 cents.

TERMS OF SUBSCRIPTIONS.—POSTAGE PAID BY US.

One copy Scientific American, one year.....\$3.20
One copy Scientific American, six months..... 1.60
One copy Scientific American, three months..... 1.00
One copy Scientific American, and one copy Scientific American Supplement, both for one year, post-paid..... 7.00
One copy Scientific American, one year, and one copy Science Record..... 5.20

We make a liberal discount and give advantageous premiums to those who form Clubs or procure Subscriptions. A beautifully illuminated Subscription List, also Prospectus and Rates, sent free.

Address
MUNN & CO.
37 PARK ROW, NEW YORK.

THE "Scientific American" is printed with CHAS. ENCE JOHNSON & CO.'S INK. Tenth & Lombard Sts., Philadelphia, and 99 Gold St., New York