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IMPROVED BRIDGE CONSTRUCTION.

The accompanying engravings illustrate improvements in the construction of bridges of long spans, on the cantilever and suspension principle combined, which was patented to J. D. Pierce on August 5, 1873.

The whole bridge, from A to B, Fig. 1, is composed of the middle truss, C D, of 316 feet, and of the two end or side trusses, A C and B D, each 296 feet long, in all 908 feet. The arches under and sustaining the side trusses constitute

triangular, quadrangular, or lenticular type, a saving of nearly 50 per cent is found in favor of the present system. With very long spans, it is claimed that the percentage of saving will be even greater. Besides, the fact of avoiding piers in navigable rivers is of considerable importance. Captain J. B. Eads tells us, in his report of June, 1868, to the directors of the Illinois and St. Louis Bridge Company, that it is idle to talk about putting piers in a river without some obstruction to navigation, whatsoever the span.

pose or inertia is claimed to be enormous, while there is little appearance of top heaviness.

High ratio of cost in long spans is avoided, in the system here advocated, by the crossing of the chords at C and D, cutting one truss, as it were, into loops of three, reducing the depth of trussing, and giving support to all by key-stoning from underneath by tension, in place of above or overhead by compression.

The dotted line, I I, Fig. 1, shows how a second grade line



PIERCE'S IMPROVED METHOD OF CONSTRUCTING BRIDGES WITH LONG SPANS.

the bottom or compression chords. The clear span between foot of arches is 680 feet. The curved line, A C D B, is a chain which is under constant tension, and which extends to an anchorage at each end, at E. The arches are hinged at E and F, and the ends of the bridge sit on curved beds of rollers at G. The chords, F D, are cut at the intersections, C and D, and joints are there placed, also to serve as hinges. Within these four hinges the structure is free to move according to thermal demands, and hence to maintain its rigidity.

Fig. 2 shows how this system repeats in spans when one is not enough to cross over the river. S T shows the grade line, P and Q anchorage of the curved tension members in their opposite arches, and R, a pier on which the spans compound one half their respective weights.

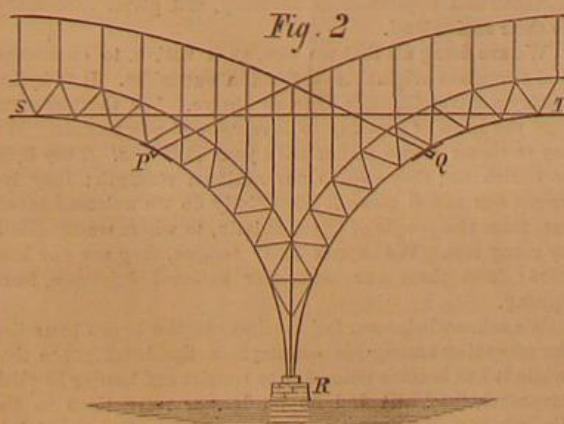
Regarding the comparative merits of this system, the inventor refers to data furnished by Mr. J. C. Trautwine, C. E., in his work on the subject. The table of weights of trusses there given, and the formula also for calculating others, has been compared with those weights of trusses as laid down in Mr. John A. Roebling's work on "Short and Long Span Bridges" and other authorities, and found to hold good approximately.

The middle truss of 316 feet, at 1.23 tons per lineal foot, weighs 388.6 tons. The other two, though a little shorter, have a weight double that of the middle truss; this sum includes the arches under them and on which they lie.

The whole bridge, track included, would weigh about 1,943.4 tons, and the total cost is estimated at \$372,757.00.

The greatest strain that comes on this bridge of 680 feet span, the inventor calculates, is less than that of a truss of 450 feet span of like requirements. Comparing the cost with other systems of rigid character, and supposing that it be desired to cross the same river, with one center truss of 680 feet and two side spans of 114 feet each, all of the usual

The anchorage is the first work begun in carrying the plan into practice. The end trusses, resting on arches, are next built out, self-sustaining. On their completion, a chrome steel chain or wire cable is drawn over the opening space. This furnishes support for putting in the middle truss. The cables first act as overhead false works; but after filling this function, when the bridge is completed, they remain as one of the supports of the middle truss, and in fact of the whole bridge, and are counted as integral members of the same.



They are shown at H, Fig. 1. By their amount of power, the curved chord (webbed to the straight ones) is relieved in strain and amount of material.

It should be observed that the structure presents a small area of surface to storms compared with others of like length of span. Anchored to the earth at each end, and with a large portion below the center of gravity as well as above, its re-

may be suspended from the trussing above, and through that below, the straight chords.

The arches are made ribbed to provide stiffness under passing trains, but the amount of material is but little increased thereby.

No high claim is made for this system when all is free to have piers low and ever so often; but where deep waters are to be crossed, and it is desirable not to interfere with navigation, then it is this plan commends itself. To places like Lewiston, N. Y., this plan is claimed to be especially suitable; as instead of a great truss 60 feet high and 600 long, as lately proposed, a depth of trussing of about 25 feet would answer. The system can also be much varied to suit localities, thus offering an interesting field for skill in designing and aesthetic treatment.

For further particulars address J. D. Pierce, Arrington, Nelson county, Va.

Mind and Health.

The mental condition has far more influence upon the bodily health than is generally supposed. It is no doubt true that ailments of the body cause depressing and morbid conditions of the mind; but it is no less true that sorrowful and disagreeable emotions produce disease in persons who, uninfluenced by them, would be in sound health; or if disease is not produced, the functions are disordered. Not even physicians always consider the importance of this fact. Agreeable emotions set in motion nervous currents, which stimulate blood, brain, and every part of the system into healthful activity; while grief, disappointment of feeling, and brooding over present sorrows or past mistakes, depress all the vital forces. To be physically well one must, in general, be happy. The reverse is not always true; one may be happy and cheerful, and yet be a constant sufferer in body. —*Brooklyn Journal of Education.*

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IMPORTANT CHANGES PROPOSED IN THE BRITISH PATENT LAWS.

For several years past a discussion has been going on in England touching the amendment of the British patent laws. A Parliamentary Committee have examined patents; the press, the patent solicitors, the Society of Arts, and many experts have assisted in the discussion. The testimony has been carefully sifted, and a very large amount of ability has been brought to the consideration of the subject. The result of these labors has crystallized in the form of a Patent Law Reform Bill, lately introduced in Parliament, and passed without serious opposition through committee. Lord Cairns, the Lord Chancellor of Great Britain, the great gun of England, was the introducer and advocate of the bill, and opened the subject by the delivery of an oratorical broadside, two or three hours in length, the report whereof, in small type, nearly fills one of the large pages of the London Times yclept the Thunderer.

His Lordship gives some striking statistics concerning English patents, illustrates the prolific and, in some instances, amusing operation of the American system, and strenuously urges the necessity of the proposed amendments, which have for their object to suppress or check the granting of patents for inventions.

The existing patent law of England provides, in brief, as follows: Patents are granted to the first applicant, whether inventor or merely introducer. No official examination is made; but all patents are printed and accessible, thus enabling applicants to make their own examinations. The patentee enjoys the exclusive possession of his patent. No one may use it without his consent. He is not compelled to work it within any specific period. If the thing patented proves to be lacking in novelty or utility, the patent is good for nothing.

These provisions are admirable for their simplicity and practical excellence; but their beneficent capabilities are marred, and indeed almost suppressed, by the heavy payments demanded by the government for issuing and certifying the patent. The duration of the patent is 14 years, divided into paid periods of 6 months, 3 years, 3½ years, and 7 years. If the official fees attached to each period are not paid up, the patent terminates on the day of failure. The total official fees now charged are £175 sterling, or \$875, for a British patent of 14 years. The British patent extends over England, Wales, Scotland, Ireland, and the Channel Islands.

For the British colonies, some twenty separate patents are required, the average government charge for which is \$200 each; making, with the home patent, a total of \$5,000, as the government demand for a patent privilege of 14 years, for the States of Great Britain. We believe there is no other nation that imposes such heavy charges upon the inventive portion of its people, nor is there any patent-granting nation that, considering the ratio of population, issues so few patents as Great Britain.

But it appears that a further curtailment has become necessary. The Lord Chancellor, in his great speech, tells us that 4,300 patents are annually applied for in England, of

which one third are abandoned at the end of the first six months, and become null, by reason of the non-payment of the sealing fees, amounting to \$125. Seventy per cent of the remainder become null at the end of the third year, by non-payment of the tax of \$250. Twenty per cent of the surviving patents terminate at the end of the seventh year by non-payment of \$500 then due, leaving less than 700 patents per annum that actually run for 14 years; while the average total life of English patents, as deduced from the Lord Chancellor's statements, provisional patents included, is only a little more than four years.

To Americans, who are accustomed to the grant of thirteen thousand patents every year, each for the full term of seventeen years, the diminutive issues of Great Britain seem like a trifling affair. But to the mind of the Lord Chancellor an English patent is a big thing.

"You have granted in this country every year," he says, "the enormous number of patents I have mentioned, and what is the effect on the industry of the country? The manufacturer, in carrying on his regular course of trade, is hampered by owners of worthless patents." "I cannot imagine anything more serious to all the manufacturers of the country than that 4,300 drag nets, more or less, should be spread, every one of them curtailing, to some extent, the area of those manufactures, and every one of them exposing manufacturers to litigation, or perhaps to the payment of blackmail, if they would escape the irksome process of litigation for an alleged infringement of patent rights."

It is to remedy this bad state of things that the Lord Chancellor urges the proposed amendments. Throughout his long speech not a single word is to be found which encourages the inventor or recognizes his title to the favorable regard of my lords' countrymen. Instead of reducing the cost of procuring patents, and simplifying the method of obtaining them, the sole aim of the Lord Chancellor's bill is to reduce the number of patents granted by increasing the difficulties of their procurement, and subjecting the inventor to new and vexatious requirements.

The new bill provides as follows: Five new Commissioners of Patents are to be added to the number now in office. Certain examiners are to be appointed. Referees are also to be chosen. Examiners and referees are to consider all applications for patents that are made, and report to the Commissioners whether the application is a proper subject for a patent, whether the papers are correct, whether the invention is new, what it consists of, whether the patent ought to be granted for seven or fourteen years, whether a patent ought to be granted at all. The law officers will then examine and report to the Lord Chancellor, who is to decide whether to allow or reject the case.

The applicant must declare himself to be the inventor; patents will not be granted except to the inventor. The patent may be revoked if the inventor fails to put the invention in operation within two years, or if the patentee refuses to grant licenses to persons who ask, on terms to be fixed by the Lord Chancellor. Government may use any patent, and make such payment as the Treasury chooses to allow. No appeals from the decisions of the Lord Chancellor. The fees remain about the same as at present.

The plain inference from the Lord Chancellor's expressions, and from the amendment he presents, is that England has no further use for the services of ingenious and originating men. Her manufacturers complain of them, and petition to have their patents suppressed. Men like Arkwright, a barber, the author of the spinning frame, who was so poor that he had to shave people in a cellar at a penny a head; men like Cartwright who, with his loom, almost built up Manchester; men like Watt, the poor instrument vender, whose steam engines furnish power for these complaining manufacturers; men like Stephenson, the poor stoker, and son of a stoker, who gave railways to Britain—the time has come, it appears, when men of this kind are not to expect further encouragement under British patent laws.

We do not propose to reason with the Lord Chancellor and his coadjutors upon the folly of such legislation. But we want their constituents to know that the American people regard the inventors of England as their benefactors, deserving of encouragement and honor. They cherish with deep reverence the memories of the long line of worthy Englishmen, humble, it is true, in family origin, who by their discoveries and inventions have filled the earth with new methods and appliances of industry, and given supremacy to their native land.

We are doing all that we can, as a nation, to encourage and stimulate original inventions in our midst. It is by industry and intelligence that we thrive. We therefore extend the hand of greeting to inventors of every clime. We say to them: Come hither with your new arts. They help to enrich us; they add to our national strength; they increase our moral power. Especially do we welcome inventors from the people of Great Britain, to whom we are allied by many ties. We speak their tongue, they are our kindred; from them our laws, our national existence, have sprung.

We acknowledge our indebtedness to the Lord Chancellor for spreading among his countrymen the intelligence that while it has become necessary to restrict and burden English inventors, they will find no burdens or restrictions in the United States. Here they will encounter few complaints against patents by manufacturers. The principal wall to be heard in this country is the cry of the manufacturer, asking inventors to study out new and practical things with which to occupy and task his machinery.

The Lord Chancellor will add to our obligations if he will again kindly announce in Parliament, and circulate the news widely in the British realm, that all Englishmen, although

denied at home, may freely obtain patents in the United States for the smallest inventions, provided they are new and useful; that patents are granted here for 17 years for the small sum of £7 sterling; that the patent covers the thirty-eight State and nine Territorial governments of the American Union; that an English patentee possesses here the exclusive control of his invention during the term of the patent; that he is not obliged to work his invention, or pay any taxes or annuities in order to preserve the life of his patent; that neither Government nor private individual can interfere, or use his patent without first obtaining his consent on his own terms.

In short, let it be everywhere made known that the government of the United States aims to encourage inventors and authors, by securing to them an absolute property in their inventions, whether great or small, for the term agreed upon in the patent. This is the one distinctive characteristic of the American patent law. It is this which gives value to our patents; and it is because they are valuable that so large a number are annually solicited.

A NEW MACHINE FOR REMOVING SNOW FROM STREETS.

The exceptionally severe season just gone by, with its heavy snowfalls and deep frosts, the remains of which have far from disappeared even yet in more northerly localities, has brought home, to the business community especially, the great need of artificial means for effectually preventing the impeding of thoroughfares by the rapid removal of snow and ice as fast as the same may form. Sweeping the snow from one part of the street on to another, or melting the same by the free application of salt, are common remedies, productive, however, of more evil than good; while the slow method of shoveling the snow bodily into carts, and thus removing it, costs, for a great street like Broadway, something like \$20,000 per mile per season. Various schemes for melting the deposit, by the application principally of superheated steam, have been proposed, and machines for that end devised and submitted to our city authorities; but up to the present time no practical tests of the proposed means, so far as we can learn, have yet demonstrated their suitability to the end in view. The street railway companies drive jets of steam down on their tracks and follow with heavy revolving brushes, but the heat in this instance merely loosens the frozen mass, which the brushes throw to one side to aid in obstructing the balance of the roadway.

With this state of affairs in existence, it was with much gratification that we recently examined a novel invention for removing snow and ice by the direct application of an intensely hot blast of flame generated by the familiar and simple apparatus of the blowpipe. The machine consists of a small steam boiler, upright and cylindrical in form, beside which another receptacle of like shape to contain naphtha is placed. The same fire serves to generate steam in one boiler and naphtha vapor in the other, and the whole is located on the front portion of a low wagon, the body of which is of iron and has a water bottom to protect the parts above from, as well as to confine, the intense heat beneath. Extending downward from the vapor chamber are one or two rows of tubes, the openings of which are in line across the bottom of the vehicle. A like number of pipes from the steam generator discharge steam jets just at the orifices of the vapor tubes; so that, the vapor being ignited, the steam mingles with the flame, becomes highly superheated, and also draws in a strong current of air to the same, through apertures in the large jacket tube which encloses each pair of pipes.

The mouth of each tube, therefore, when the machine is in operation, emits a steady stream of flame, hot enough, as we saw, to heat clay and stone beneath it to a bright red in a very few minutes, and certainly sufficiently powerful to demolish several inches of ice or snow by merely passing over. In fact the space beneath the apparatus, at the orifices of the tubes, looked like the interior of a furnace under a strong draft; and this heat, as the wagon advances, is carried under the same and confined by the body above and flexible runners, reaching to the ground on the sides, front, and rear. The mere force of the escaping blasts is sufficient to make cavities of some little depth in hard ground, when the machine is standing still, and to scatter ice and snow so thoroughly as to allow such as escapes complete melting to be easily swept away. It will be observed that the main objection to a steam blast, superheated or otherwise, namely condensation, is here absent, and that the heated gases are not merely applied to the surface of the mass, but driven directly into its very substance.

The inventor, Mr. C. G. Waterbury of this city, has made the subject an especial study for some years past; and judging from the favorable notice which his device is already receiving from city officials and others, there is a fair probability of its adoption, and some prospect of our streets being kept clear during next winter. It is proposed to put six machines at work on Broadway at the beginning of every snow storm, and let them melt the snow as it falls. A few men with brooms could quickly drive the water produced off toward the sewers, and thus that banking and caking of the snow which so effectually blocks the streets to traffic would be obviated.

PROGRESS OF RAPID TRANSIT IN NEW YORK.

The movement to secure the completion of a rapid transit railway through this city is beginning to take practical shape, and it will not probably be long ere the matter is brought to a successful conclusion. It is conceded on all sides that the principal obstacle in the way is the depressed financial condition of the country. Those who own first class real estate, in our midst, have for a long time been unable to sell or realize money thereon, except in ruinously small amounts,

and it is therefore not surprising that even the best of our rapid transit schemes should languish for want of funds. Some of our enterprising citizens, who know this but are determined that Rapid Transit shall no longer rest, have formed an association to promote the matter financially, by raising a fund of three millions of dollars, to be applied in carrying out whatever plan the subscribers to the fund may decide to be best, after the money is raised. They have ascertained by experience that, if plans are to be first discussed, there will be no end to the discussion, and no time left to obtain subscriptions. They have therefore decided to raise the money first, and talk afterwards, which is assuredly a very practical method of procedure.

At a recent meeting of the association, a board of directors was nominated, consisting of eminent and reliable citizens, in whom the public have great confidence. Progress of subscriptions was also reported, when it appeared that three hundred thousand dollars, or ten per cent of the whole amount, had been already pledged. This is certainly very encouraging.

The speakers reminded those present that a splendid line of rapid transit railway, half way through the city, was almost completed, and would be put in operation within a few days, namely, the Harlem Underground, and that it only needed the continuation of the same tracks down to the Battery to furnish New York with a better system of local communication than that of any other city in the world. It was suggested that, while it was out of place for the Association to discuss particular plans, still the members and others who were interested might do well to examine the works above mentioned, where all the various forms of railway that are being advocated, the Elevated, the Open Cut, and the Underground, may be examined and compared, and their effects upon the value of adjoining property, and their relative interference with the public uses of the streets, studied to the best advantage.

It was suggested that the great viaduct between 98th and 116th streets was perhaps as fine an example of the Elevated, or high level railway, as could be built, although it filled up the street, and the adjoining property would be found to be less in value than elsewhere on the line. The depressed or Open-Cut railway could be seen to the best advantage where it passes through the main street of Harlem, from 116th street to 133d street. It would be found that this plan, while it was less objectionable than the elevated, still occupied and absorbed the best portion of the avenue, and was disadvantageous to the adjacent property. The Underground railway could be studied between 56th street and 96th street, and here, above the railway, would be found a broad and magnificent avenue, beautifully paved and regulated, of park-like appearance, especially desirable whether for business or residence, and here the adjoining property would be found to be higher in value than at any other point along the line.

The remarkable conjunction of all these different methods of city railway construction upon the same street, all the examples being of equal capacity for traffic, certainly affords to our citizens the best possible opportunity for correctly deciding which of the methods is the best for construction down through the business and crowded parts of the city.

The recent construction of these different styles of railway also places before our citizens positive evidence of the actual cost of building on either plan. In this respect the construction accounts will, we think, show that there is little to choose in the matter of economy between either of the forms. If there is any difference, the high level road will be found to cost probably more than the low level railway, capacity of traffic being equal.

We recently gave an engraving of the shaft of the Hudson river railway tunnel, which has been commenced on the Jersey City side of the Hudson, designed to lead the tracks of the great railways, which there center, directly into the southern part of New York by the underground method, the same as is now done at the northern part.

The city of New York will undoubtedly require ere long several independent lines of rapid transit railways, but what particular forms of construction should be employed, whether they should all be alike or different, it is perhaps too early now to determine. The general conclusion reached by the Rapid Transit (Elevated) Railway Committee of the Civil Engineers' Society is that each main line must have a traffic capacity at least equal to the London Underground Railways. In this conclusion everybody will agree. The standard for passenger accommodation is that afforded by the Underground. Nothing less will satisfy the public. The suggestion naturally follows: "Why not, for a first main line, complete the work so nobly begun, by carrying the Underground road down town at once?" The indications are that this will be done. We have only to add 4½ miles to the work already built, when we shall have in operation a safe, capacious, and fast railway underground from the Battery to Harlem river, a distance of nine miles.

Several excellent charters for fast railways in New York have been granted, and a bill is pending before the State legislature for a general law empowering the formation of other companies. So we are not likely to lack for franchises. But the tendency of this multiplication of charters is to hinder rather than to promote rapid transit. The immediate question for builders will be: Which, on the whole, is the best route for business? Which line will be the most sure to return a reasonable interest on the large expense which the work inevitably involves? The eminent British railway engineer, Mr. John Fowler, affirms that local or city railways, in order to ensure to themselves the largest amount of permanent traffic, must be located directly on the lines of greatest local travel, where they constantly

command the public attention. In this view, the Broadway line would seem to have pre-eminent advantages. No other street in the world is so constantly crowded with travel. The gradual changes which are going on along this thoroughfare, by the erection of gigantic buildings, point to a day, not far distant, when its local population alone will suffice for a generous support of a railway placed under its pavement; and that if all the side avenues had their rapid transit rails, the Broadway line would never suffer for lack of business.

AMALGAMS FOR FILLING THE TEETH.

An article under this heading, published in our paper of January 3, and referring to observations on the subject made by Dr. Clowes, of this city, before the Odontological Society, has called out a number of communications from members of the profession. We regret that our limited space prevents their publication. Dr. A. C. Castle, M.D., of this city, one of our oldest practitioners and a well known scientist, sends us an excellent article on the subject. Probably no one in the profession has had greater experience than he in the matter. He, by the way, calls our attention to a misnomer in our article, where we spoke of the use, by Dr. Clowes, of tin amalgam. We should have said dental amalgam, as every intelligent reader doubtless understood. It was the usual dental amalgam or compound, containing tin and silver, with sometimes other ingredients, that we referred to.

Dr. Castle tells us that he has been in the full practice of medico-dental surgery in this city for the last forty years, and during all that time has been constantly using amalgam fillings for badly decayed teeth. He gives us an interesting account of the early battles that took place a generation ago among the dentists. Dental amalgam was introduced in this city by his father, in 1829. In 1846, the late Dr. Eleazer Parry, an eminent dental practitioner, began hostilities against the filling, on the score of injury to health, etc.; but when challenged to produce proofs, he utterly failed. On the other hand, Dr. Castle brought forward the most indisputable evidence, medical, metallurgical, and professional, fully sustaining the utility of the amalgam. From that time to the present, Dr. Castle tells us, its popularity and use, to apply a strong figure of speech, has advanced, almost, as it were, by a geometrical progression. To Dr. A. C. Castle, and primarily to his father, the profession is indebted for the introduction, improvement, and practical exemplification of this highly useful agent.

Dental amalgams, says Dr. Castle, can only be formed under certain conditions. Platina, unless melted with and combined with silver, will not form an amalgam. Tin will mix with mercury, but it will not crystallize or harden without a large addition of silver. So it is with gold and other metals. Silver is absolutely necessary to make hard amalgams for the teeth. But silver is affected by gastric acids and gases, which discolor dental amalgams, and, in many mouths, even the purest gold. In the shape of an amalgam, the quicksilver modifies the character of silver, rendering it less liable to the action of the gastric acids, and as durable in the teeth as the other metals or fillings used for this purpose.

TEST OF AMERICAN IRON AND STEEL.

The Sundry Civil Appropriation Bill, passed among the last acts of the late Congress, contained an appropriation of \$75,000 for tests of iron and steel, to be made by a board of engineers, who were to serve without pay, with the exception of the secretary. The members of the board have recently been appointed by the Secretary of War, as follows: Colonel T. T. S. Laidley, Ordnance Department, U. S. A., resident; Professor R. H. Thurston, Secretary; Commander L. A. Beardslee, U. S. N.; General Q. A. Gillmore, Engineer-Department, U. S. A.; Chief Engineer David Smith, U. S. N.; W. Lovy Smith, C. E.; A. L. Holley, C. E. A testing machine is to be built, and set up at the Watertown Arsenal, where the experiments are to be conducted. The board will receive instructions from, and report to, the Chief of the Ordnance Department of the Army.

The members of this board are all well known engineers, several of whom have already distinguished themselves by their investigations of the properties of materials used in construction. It would be difficult to over-estimate the value of their future experiments, if carefully conducted. To mention a single instance, it may be stated that the English formula deduced from Gordon's experiments is almost the only authority available to our engineers for computing the resistance of materials to compressive strains. Very few of our engineers could afford to make such experiments as they desired; and when such investigations were conducted by companies, the results were not usually available for general use. It seems probable, therefore, that the appropriation, made by Congress for these experiments, will be productive of more good than many other items for which ten times the amount was allotted.

ANOTHER EARTHQUAKE INDICATOR.

In a late number of the SCIENTIFIC AMERICAN we gave an illustrated description of the earthquake indicator of Count Malvaris, of Bologna, Italy. A much simpler device has been for some time in use at the Cambridge Observatory, Mass. This was adopted by Professor Winlock, the distinguished astronomer, the Director of the American Nautical Almanac, and it is an excellent illustration, taken with the first described instrument, of the comparative simplicity of Yankee devices, and the directness with which American ingenuity attains its object.

The great equatorial at the Observatory of Harvard College is mounted upon a massive granite pier, whose foundations extend far below the surface of the ground. The

floors of the building are carefully kept out of contact with this pier, in order that no tremor may be communicated to the telescope by the structure. This pier can therefore only be moved by actual motion of the earth. Four little pins, slightly conical in form, are balanced, small end down and large end up, on the upper face of the pier. They are so nicely pointed that it requires some skill and care to set them up. Once set up, only movements of the earth will throw them down. When thrown down, the direction in which they lie indicates the direction of the earthquake wave. At the time of the shake which so seriously disturbed our neighbors of Westchester county, one of these pins was found overthrown, indicating that the shake probably affected slightly the Hub of the Universe.

We presume that many of our readers will adopt the Cambridge earthquake indicator, and that we shall learn from them the direction of movement and the extent of the next earthquake. This little device is far simpler and, we think, more accurate and reliable than that of the Italian Count.

KAOLIN IN THE UNITED STATES.

A letter appears in our correspondence columns, signed by Mr. S. D. Morgan, of Nashville, Tenn., in which the writer takes the ground that we labor under a mistake in stating that kaolin suitable for fine porcelain is not produced within the United States. Our statement was based on the assertion of one of the oldest, as well as one of the largest, consumers of the clay in the country, and that gentleman assures us that, though he would be highly gratified if he could substitute an American for a foreign raw material in his manufactures, and that he had endeavored to awaken interest in the discovery of suitable kaolin beds, as yet his wishes and efforts have been entirely futile. We are well aware that there is an abundance of kaolin deposits open; but we have yet to learn of one in which the material is sufficiently free from iron and other impurities to serve the purpose of manufacturing the fine grade of porcelain, to the description of which our recent article was devoted.

SCIENTIFIC AND PRACTICAL INFORMATION.

NEW POISONOUS SNAKE.

A wonderful poisonous snake has just found a home in the London Zoological Gardens. This is a snake-eating snake, hence called *ophiophagus*. Dr. Fayer has ably described this creature. We learn from him that this most formidable of poisonous snakes is found, but not commonly, in India, the Andaman and Philippine Islands, etc. It is the largest and most formidable of known venomous snakes. Shortly after his arrival he was fed by the keeper, who put an ordinary English snake into his cage; the *ophiophagus* quickly devoured the English snake by bolting him head first. In general appearance this new snake is very like a common cobra, except that, when he spreads his hood, he is seen to be marked in very pretty bands, not unlike the patterns on oil cloth. The head is somewhat almond-shaped, exceedingly lizard-like, not flat and triangular like that of the rattlesnake. When sitting up with his hood expanded, the snake is continually jerking his head in a restless manner, reminding us of the quick, darting action of the common green lizard; the eye is exceedingly clear and bright. When disturbed he hisses loudly, and shows his temper by extruding his long, black, forked tongue, which he vibrates with marvelous celerity. The lower part of the glass of the cage now inhabited by this snake has been painted white, in order that his naturally hasty temper shall be disturbed as little as possible by the morning calls of visitors.

PRAIRIE CHICKENS AND GRASSHOPPERS.

While naturalists and entomologists are puzzling over the discovery of some plan to prevent the recurrence of the grasshopper plague in the Western States during next fall, it would be well for them to take the immense yearly slaughter of the prairie chickens into consideration. The numbers of these birds which are slaughtered each winter by trapping after heavy snow storms, and find their way to the markets, are something enormous; and as the grasshoppers constitute a great part of their natural food, it seems not improbable that the disappearance of the former might exercise a very appreciable effect in the increase of the devastating insects.

ANILINE INKS.

The majority of aniline colors soluble in water furnish inks of excellent quality. Dingler's *Polytechnische Journal* of recent date gives the following practical recipes for their preparation, by which any one can make the fluids very easily: Violet ink is obtained by dissolving one part of aniline violet blue in 300 parts of water. This ink is quite limpid, dries quickly, and gives a remarkably dark color. It is necessary that new pens should be employed in using it, as the smallest quantity of ordinary ink mixed with it causes its alteration. Blue ink is made by dissolving one part of soluble Paris blue in 250 parts of boiling water; red ink, by dissolving one part of soluble fuchsin in 200 parts of boiling water. While ordinary inks are decomposed by numerous substances, and notably by hydrochloric acid, aniline inks are completely ineffaceable from the paper on which they are used. They resist the action of acids and even of chlorine.

EBULLITION OF SULPHURIC ACID.

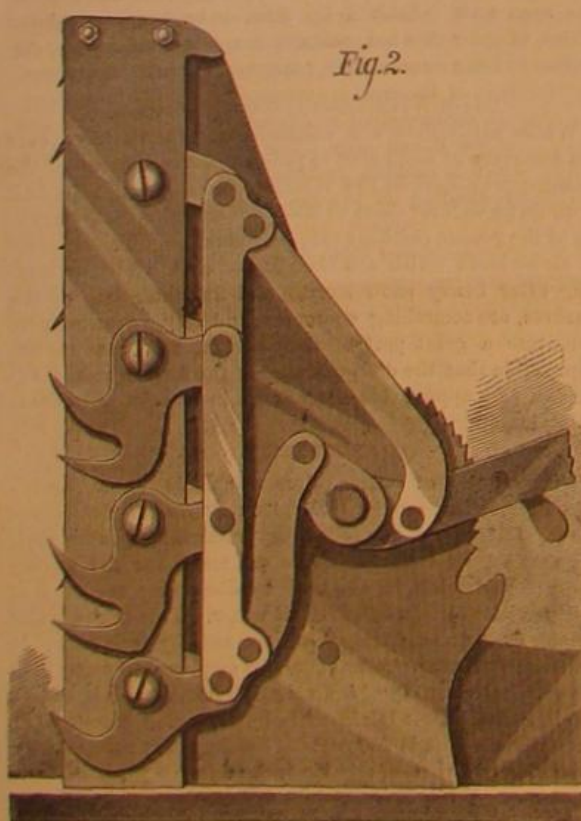
According to M. Bobierre, sulphuric acid may be caused to undergo regular ebullition by the addition of thin plates of platinum in the proportion of 180 grains of metal to 32 quarts of acid. The whole is to be treated in a vessel of 55 quarts capacity.

BECKWITH'S IMPROVED LUMBER DOG.

The annexed illustrations represent an improved form of lumber dog, the advantages of which are plainly set forth, and will be appreciated by those engaged in working lumber. The lever, when drawn up as shown in Fig. 1, and secured by the ratchet, thrusts two sets of teeth into the log, one pointing upwards and the other down. This arrangement is claimed to be the only one by which timber of any shape, square, round, or irregular, can be firmly seized, held, and drawn to the standard; and this advantage is secured by a very slight exertion of manual power on the lever. In Fig. 2, the device is shown with the lever down and the



teeth in the normal position. These dogs may be attached to any ordinary standard. They are made of steel almost entirely. The pivots on which the teeth vibrate are solid with the bed plate, and are of cast steel one inch and an eighth in diameter. The ratchet and pawl on the lever prevent any possibility of the dogs letting go the log, and the double teeth, pointed in opposite directions, give a grip of great power. By applying a universal joint to the connecting shaft, the dogs may be attached to head blocks independent of each other, so that it makes no difference whether the standards move parallel with each other or not, as the dogs move simultaneously from the motion of one lever. The makers supply standards containing the dogs, which may be substituted for any other standard, winged or otherwise. These standards are made with wide faces; and as the teeth of the dog emerge from the center of the face, they have no tendency to spring the cant. Any size of log up to



18 inches may be sawn up from the first dogging, without rolling the log, as two teeth must enter the lumber, and these are sufficient to hold it securely. When the surface towards the dogs is wide, five or more teeth can be driven in, at the will of the operator.

Patented December 26, 1871, to N. F. Beckwith, and further protected by patents now pending. For further particulars address Messrs. Filer, Stowell & Co., Cream City Iron Works, Milwaukee, Wis.

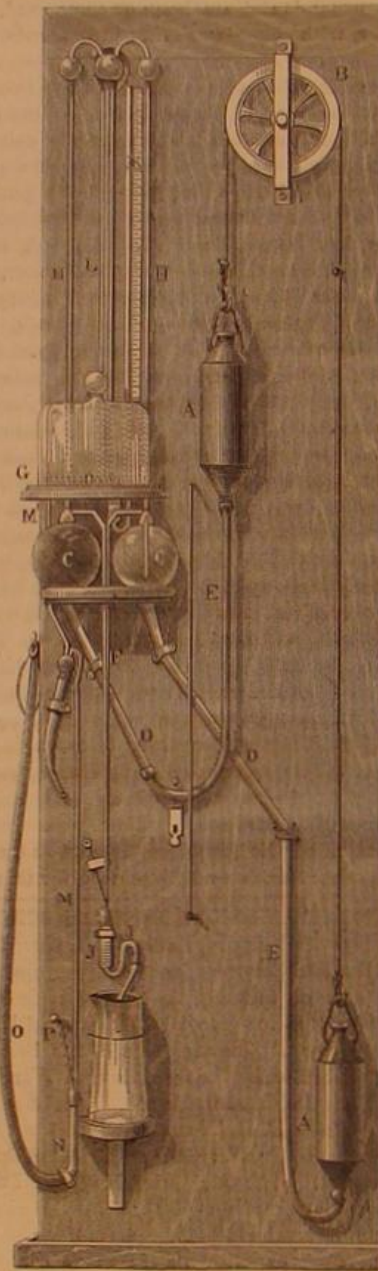
A NEW MERCURY AIR PUMP.

M. De Las Marismas has recently presented an air pump of his invention to the Academy of Sciences, Paris. It is somewhat similar to that of Mr. Sprengel, and the following advantages are claimed for it:

It is of easy and cheap construction, costing only about \$7. It works rapidly and without causing fatigue. The vacuum is obtained within one millimeter (0.039 inch), in a receiver of the capacity of 14 gallons in about four minutes. Experiments may be made at all pressures, from the atmospheric pressure up to absolute vacuum. It permits the reception of the air or gas contained in the receiver employed for experiment, and also, to within 0.039 inch, the admission of such gases as may be desired. It is self-acting, and therefore avoids all those errors incidental to the working of mercury air pumps of which the cocks are obliged to be worked by hand. Lastly, it can maintain the vacuum indefinitely.

The proportions of this machine, which are limited to the size of a laboratory instrument, may be augmented according to whatever requirements may be desired. Those parts which are constructed of glass may be made of iron, whenever it is not necessary to employ gases which attack that metal.

The following is a description of the instrument:



This machine is composed of two reservoirs of cast iron, A A, which counterpoise each other, and are supported by the pulley, B. They communicate with two glass balloons, C, by means of the glass tubes, D, and of the india rubber tubes, E. They are filled with mercury, which, when one of the reservoirs is lifted, passes into the balloon, and drives the air out of it, through the capillary tube, F, which is soldered to the top, at the same time that the other reservoir, in falling lower than 29.64 inches, causes the mercury to quit the other balloon, thus forming a barometric vacuum. The balloons communicate with the plate, G, by the glass tubes H, which plunge to within 0.39 inch of the bottom of the balloons. They are automatically closed as soon as the mercury rises within the balloons to drive out the air, and opened as soon as it retires to produce the vacuum. The air cannot re-enter the balloons by the tubes, F, after having been once driven out, because, in order to escape by the orifice, I, it is obliged to pass through a slight layer of mercury contained in the curved tube, J and when the vacuum is formed in the balloons, the atmospheric pressure causes the mercury to mount up again in the tubes, and thus prevents the return of air. In order to receive the air or gas contained in the plate, or in the vessel to be experimented on, all that is to be done is to place the required recipient in communication with the orifice, I.

The degree of vacuum produced is indicated by the barometer, K, which communicates with the plate by the tube, L, and enables experiments to be made at all pressures comprised between atmospheric pressure and absolute vacuum.

The return of the air is effected through the tube, M, which communicates on one side with the plate, and on the other plunges into the mercury contained in the bent tube,

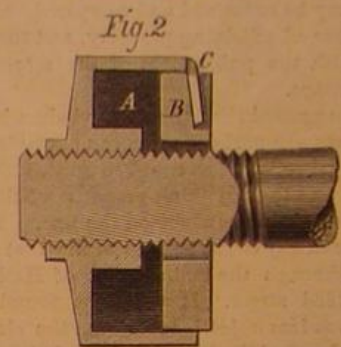
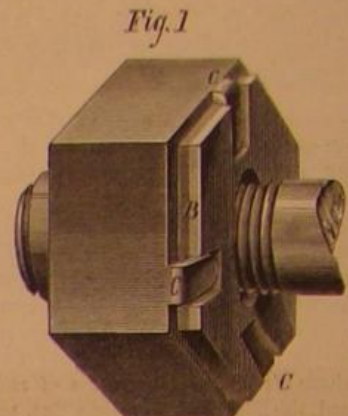
N. The level of the mercury may be changed by elevating or lowering the india rubber tube, O, and thus uncovering at will the extremity of the tube, M; the return of the air upon the plate is regulated to within 0.039 inch.

If it is wished to admit any other gas, the recipient containing it must be placed in communication with the tubular opening, P.

We select the engraving from the pages of the *Practical Magazine*.

DITTMAN'S IMPROVED LOCKING NUT.

The nut lock herewith illustrated, in perspective (Fig. 1) and section (Fig. 2), is so constructed as to prevent the backward rotation of the nut under the influence of jars and



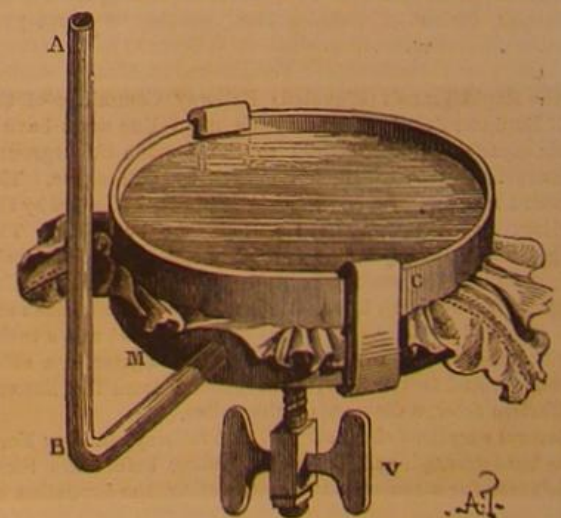
jolts, and also to take up automatically the expansion or contraction of the bolt, due to changes of temperature.

An iron nut is provided with an outer higher shell, the space between forming a chamber to receive the rubber, A. The latter extends almost to the top of the shell, and is, by the compressive force of a follower, B, expanded until it comes in frictional contact with the threads of the bolt. This prevents the nut from turning on the bolt, as the rubber serves as a lock, while the expansion and contraction of the bolt are taken up by corresponding expansion and contraction of the rubber. The washer or follower, B, has recesses inclined at the bottom and adapted to receive the lips, C, which project upwardly from the edge of the shell. This serves the purpose of holding the parts of the device together for transportation, etc., while it also locks the washer to the nut when the latter is screwed down upon a fish or other plate.

Patented through the Scientific American Patent Agency, September 8, 1874. For further particulars regarding sale of entire right during the next twenty days, or relative to licenses thereafter, address the inventor, Mr. Caspar Dittman, Leacock, P. O., Lancaster county, Pa.

APPARATUS FOR DETERMINING THE IMPERMEABILITY OF TISSUES.

We extract from *La Nature* the annexed illustration of a simple device for determining whether or not any given tissue is impermeable to gases. The utility of the device is principally found in testing silk and other fabrics used for



balloons, or for proving waterproof varnish when spread on tissues.

The apparatus is a metallic cup, M, to which a tube, A B, is affixed. The material to be tested is placed over the mouth and there strained between a band of rubber (attached to the exterior of the cup) and a ring, C, held in place by double clamps and a set screw. The fabric is then covered with water and air is blown in through the tube. If the stuff is not absolutely impermeable, minute air bubbles will make their way through and rise in the water.

THE SUN'S POSITION AT DIFFERENT SEASONS OF THE YEAR.

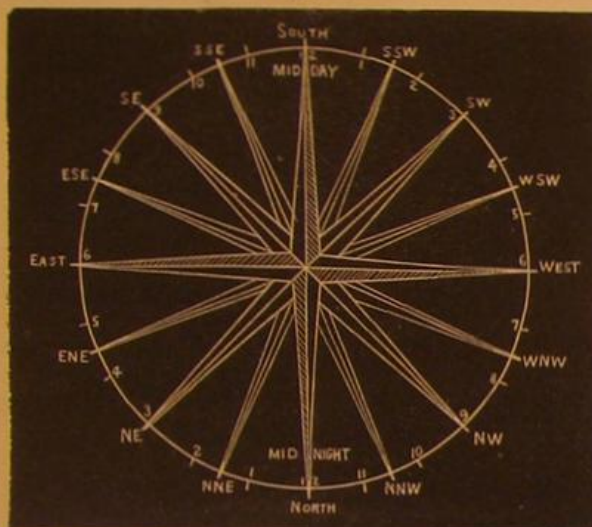
It is a universally known fact, says Herr Jaffe, in consequence of the inclination of the earth's axis at the ecliptic, the sun sometimes stands higher and sometimes lower over the horizon. It is, however, less known that, simultaneously with this change of altitude, a variation also takes place in the sun's relative position to the points of the compass. With us, as in the whole temperate zone of the northern hemisphere, the sun's position at noon is due south; and from this one is led to assume, since the earth performs a revolution every twenty-four hours, and every point upon its surface describes an entire circle, that the sun always stands in the east at six A. M., in the west at six P. M., in the south-east at nine A. M., and in the southwest at three P. M., etc.

At Vienna, on the 48th degree north latitude, the following, however, is proved to be the case. The sun stands:

	E.	S.E.	S.	S.W.	W.
	A.M.	A.M.	NOON.	P.M.	P.M.
On the 21st December . . .	—	9-10	12	2-50	—
On the 21st March . . .	6-0	9-50	12	2-10	6-0
On the 23d of September . .	6-0	9-50	12	2-10	6-0
On the 21st of June . . .	7-10	10-30	12	1-30	4-50

Whoever wishes to test the accuracy of this statement should proceed as follows: Divide the circumference of a circular dial, Fig. 1, into twenty-four equal parts, mark these

Fig. 1.

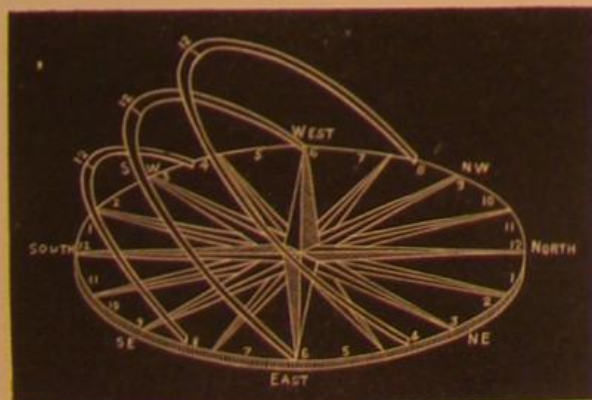


divisions with the numbers of the hours, from one to twelve A. M., and from one to twelve P. M. Then draw upon it the dial face of a compass, so that the south may coincide with twelve, noon. Then cut three narrow circles of the same circumference as the dial, and divide and mark their outer edges with the hours in the same manner as before. Cut one of the circles off at eight A. M. and four P. M., the second at six A. M. and six P. M., and the third at four A. M. and eight P. M., and fasten the ends of all three arcs to the corresponding hours upon the dial, so that they are inclined towards the south at an angle of 42° to the dial. Fig. 2 is a perspective view of the finished model.

The parts of the circles cut off represent the sun's orbit as it appears to us in Vienna, Munich, and all other places which lie 48° north—the first on the 21st December (the shortest day), the second on the 21st March and 23d September (when the days and nights are equal), and the third on the 21st June (the longest day). In order to find out the sun's position at a given hour on any of these days, one has only to let fall a perpendicular from the particular hour and arc to the face of the dial, and read off the name of the point of the compass on which the line falls.

The sun's position for all the other days of the year is very easily reckoned when once the four already spoken of are found. Naturally, the construction of the model has to be changed for different degrees of latitude. The further

Fig. 2.

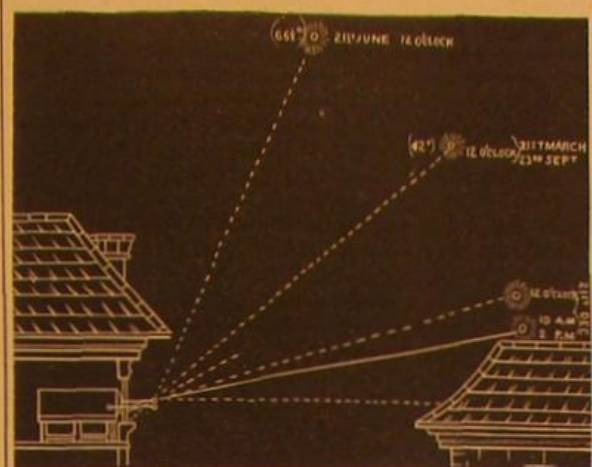


north the longer the longest day will be, the shorter the shortest day, and so on. Also the angle which the segments of circles must make with the dial will be altered, this angle always expressing the difference between the number of the degree of latitude and 90. For example: For St. Petersburg, on the sixtieth degree of latitude, the angle would be 30°; For Naples, Madrid, and Constantinople (41° N. lat.), it would be 49°.

Many a photographer must have wondered how it is that the same building should be touched by the sun's rays on one side in winter at a given hour of the day; and at the selfsame hour in summer, it should be touched on the oppo-

site side. To such a one the foregoing statement would be useful, if he wishes to decide upon a time and site for building, by means of a compass, a helioscope, or Wehl's "Guide to Building," since a beautiful shadow really contributes to

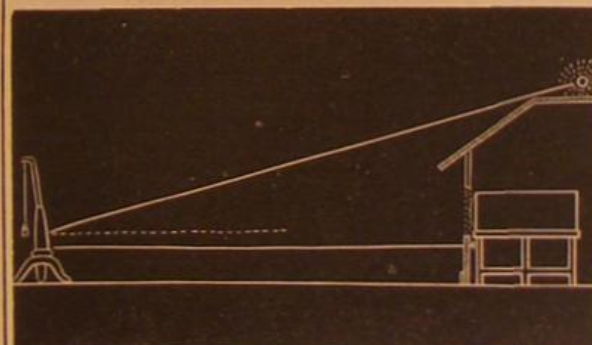
Fig. 3.



the perfection of the picture. Indeed, by means of this model, one can always study the shadows as they would be produced by the sun's rays falling on a building favorably and definitely situated, both geographically and with reference to the points of the compass. For this purpose the model must be pretty large. Take it into a dark room and set up, upon the dial, the model of a building with prominent pillars, ornaments, projections, etc., taking care that the model of the building about to be observed is placed exactly on the center of the dial and in the desired direction of the compass. The light of a candle held to one of the arcs will show the direction in which the shadows will fall on the building on that day of the year for which the arc is specially constructed. The foregoing would also prove useful to any one looking out for a site for a studio or an enlarging apparatus, especially the latter, since the angle formed by the arc of the 21st December and a line raised from the center of the dial is that by which the mirror will receive unobstructed light and be struck by the sun's rays on the shortest day. At Vienna, on December 21, at noon, this angle falls as low as 18½°, and at ten A. M. and two P. M. yet 5° lower, so that the sky would only be unobstructed for 13½°; and about Christmas the illuminating power of the lens is diminished below the point of utility. (See Fig. 3.)

It may be remarked here that for the latitude of Vienna an enlarging apparatus, erected on Wothly's system, with the mirror in the north as shown in the diagram, Fig. 4, is much to be preferred to that on Monckhoven's system, with

Fig. 4.



the mirror on the south; because, while in winter Monckhoven's mirror only gives sunlight to a small part of the lens, by Wothly's system the whole of it can be illuminated at every season of the year, as the mirror must be placed about eight times the diameter of the lens distant from it, thus allowing the whole of its plane to receive the sun's rays even in the shortest days. Another advantage of Wothly's system consists in this, that no direct rays of the sun fall on the combination lens. With Monckhoven's mirror this is unavoidable.

In conclusion, we will only make one more remark. A single glance at our model shows that the sun's ascent from ten to twelve, and its descent from twelve to two o'clock, is very slight, while before ten it rises rapidly, and after two it falls as quickly to the horizon. This is, then, the reason why the light from ten to two possesses about equal power, while it increases rapidly up to ten, and from two decreases again with the same rapidity.—*Photographische Correspondenz.*

The Duration of Life.

The following facts on the duration of life appear in the *Deutsche Versicherungs Zeitung*: "In ancient Rome, during the period between the years 200 and 300 A. D., the average duration of life among the upper classes was 30 years. In the present century, among the same classes of people, it amounts to 50 years. In the sixteenth century the mean duration of life in Geneva was 21 2/3 years, between 1814 and 1833 it was 40 6/8 years, and at the present time as many people live to 70 years of age as 300 years ago lived to the age of 43.

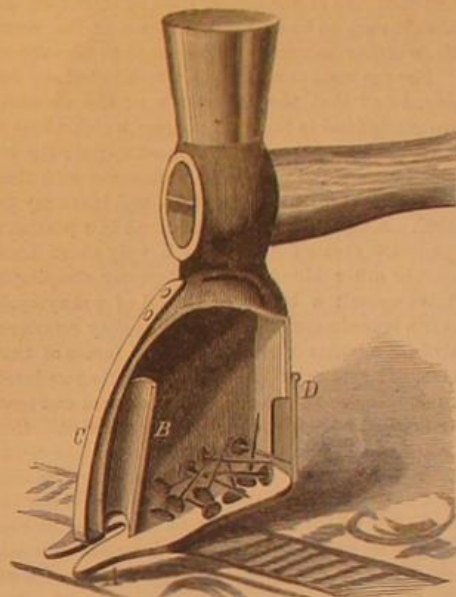
A New Kind of Poisonous Dress Goods.

Professor Gintl says that in some English and Alsatian print works the expensive albumen is partially replaced by glycerin-arsenic and acetate of alumina. Some of the dress goods in the market contain 3 or 4 grains of arsenic in a

yard of the stuff. Muslins and cambrics with little white spots, circles, stars, or flowers, on a violet ground, and those printed with brownish yellow or reddish brown patterns, have been found to contain arsenic; and these are colors which have never before been considered with any suspicion, and would be purchased by the uninitiated without any foreboding of the danger that would attend the wearing of such dresses. The danger is no slight one; for aside from the large quantity of arsenic in it, the compound is not an insoluble one. If the goods are soaked in water, there is dissolved out a sufficient amount of arsenical salt to give a distinct reaction. This latter peculiarity is explained by the supposition that the goods, being comparatively cheap, are not washed or rinsed after printing, but sent directly to be finished.

A NEW TACK HAMMER.

Any one who has ever drawn a tack from the floor, with the usual claw found on tack hammers, has doubtless seen the tack yielding to a sudden jerk, spring out of the board, and disappear into some hidden fold of the carpet, there to remain until it finds its way into somebody's foot or fingers. Mr. George H. Ryer, of this city, has devised a way of preventing that difficulty, by forming a receptacle in the rear of the hammer head, as shown in the annexed engraving. The base of this chamber is a steel plate having at its front end



forked projections, A, the slit between which extends back into the plate. Just in rear of the slit is a curved piece, B, and at the opening between plate and receptacle is a spring, C. The head of the tack enters the slit as represented, and easily passes the spring. A downward movement of the handle then draws the tack, which, falling on the piece, B, when the hammer is tilted back, slides into the receptacle. When the latter is full its contents are emptied out, on opening the slide at D.

THE ANATIFA.

The anatifas are among the most curious inhabitants of the ocean world. They are a kind of barnacle, attaching themselves to drift wood, rocks, and vessels, and supporting life upon minute animalcules gathered from the sea water. The structure of the creature consists of a calcareous miter-shaped shell, composed of five pieces, two on each side and the fifth on the dorsal edge. The shell rests upon a thick pedicle, which is tubular, flexible, opaque, and of a brown color above, shading off to a flesh tint below. The animal has no power of locomotion except in swaying slowly to and fro. In order to obtain food, it is provided with twelve or



more arms on each side, which are closely contracted when in repose; but when sweeping the adjacent water for animalcules, are widely extended. The two sexes are associated in the same individual. The young, on emerging from the egg, swim about with ease, being provided with large movable fins and a huge eye in front. These organs disappear in the adult, as it gradually becomes fixed by its pedicle.

Ancient naturalists held the queer fancy that these creatures were legged eggs, deposited by some bird like a duck, and up to the present time fishermen have a similar superstition, probably due to the feathery appearance of the arms when spread out.

Correspondence.

The Plague of Flies.

To the Editor of the Scientific American:

Mr. William Steele is not the only person in the country whose troubles from the encroachments of insects are sufficient to inspire a wish for the invention of some infernal machine to extirpate such pests as sand flies, fleas, etc. But it seems to me that the dissemination of science and a better knowledge of entomology are what is most needed in this direction.

I have not seen a bedbug or a flea in my house for many years. If an army of them were to be brought in, mercury would speedily exterminate them, but I think cleanliness the best and perhaps the only preventive. The common house fly I do not molest, believing that it more than compensates for its trouble by clearing the atmosphere of effluvia and the animalcules which always arise from the putrefaction of decaying substances during warm weather. So, also, with the birds, which are quite numerous here during the summer; instead of shooting them, or setting up scarecrows to frighten them away, I throw out every possible inducement for them to build their nests in my fruit trees. The birds capture a large share of the insects in the larval state, and thus the millers are prevented from depositing eggs for a future crop of worms. As to the loss of fruit by the birds, the latter are always sure to be on hand in force in the season of ripe fruit, whether they come early enough to take the worms or not. For the residue of insects which infest my vegetable garden, I find that the laboratory of the chemist furnishes materials fatal to them all, among which white hellebore and cayenne pepper are of the most utility; the bug or worm which cannot find vegetation unflavored with these articles will seek its breakfast elsewhere, and leave my garden unmolested. A few drops of carbolic acid in a pint of water will clean house plants from lice in a very short time. If mosquitoes or other bloodsuckers infest our sleeping rooms at night, we uncork a bottle of the oil of pennyroyal, and these insects leave in great haste, nor will they return so long as the air in the rooms is loaded with the fumes of that aromatic herb. If rats enter the cellar, a little powdered potash, thrown into their holes or mixed with meal and scattered in their runways, never fails to drive them away. Cayenne pepper will keep the buttery and storeroom free from ants and cockroaches. If a mouse makes an entrance into any part of your dwelling, saturate a rag with cayenne in solution and stuff it into the hole, which can then be repaired with either wood or mortar. No rat or mouse will eat that rag for the purpose of opening communications with a depot of supplies.

CHARLES THOMPSON.

St. Albans, Vt.

The Sun's Orbit and Rate of Motion.

To the Editor of the Scientific American:

In your issue of March 27, 1875, page 196, Mr. John Hepburn makes a singular oversight, in confounding the angular motion of the earth's pole with the linear motion of the sun and solar system in space, which he makes about 8,000,000 miles a year; whereas the calculations of our best standard astronomers make it at least 200,000,000 miles, and some make it more than three times as much. The time of the great revolution has been stated at from 10 to 30 millions of years, instead of 25,800; and the great orbit at least 240,000 times as large as that of Neptune, instead of 12 times.

For the benefit of your readers who are not acquainted with mathematical astronomy, I will give you simple illustrations of these two motions. Draw a small circle on paper, and make a spot in the center for the earth's orbit and place of the sun. Make a rude top, with a wheel, an inch in diameter. Let the pointed end of the axis project $\frac{1}{2}$ inch. This axis and plane of the wheel will make nearly the same angles, with the plane of the paper on the table, as the earth's axis and equator with the ecliptic. Put the point of the axis on the circumference of the circle, keep it in the same place, and roll the wheel round on the paper. The axis describes a cone, pointing differently at each successive instant; and if the axis were extended to the ceiling overhead, or to the heavens, it would describe a circle there. If, while rolling the wheel round the pivot, you moved the pivot round the circumference of the circle on the paper, the axis would describe a like cone and circle. When you have rolled the wheel half way round, the axis will make an angle, with the line on which it was at the start, twice as large as the plane of the wheel makes with the plane of the paper, but all the time at the same angle with the plane of the paper. Similarly to this, the axis and pole of the earth describe a cone and circle in the heavens; but so slowly does the earth's axis vary from parallelism, that it takes 25,800 years to complete the circle. The linear motion of the sun in space may be aptly represented by carrying an orrery round the world. The contrast between the circle on the paper and the circle of the earth is no greater than that between the earth's yearly circuit round the sun, and the sun's great circuit round some inconceivably distant central sun.

Kankakee, Ill.

S. N. MANNING

Kaolin in the United States.

To the Editor of the Scientific American:

In your recent article on "Porcelain Manufacture in New York," you tell us that the kaolin used is imported from England, and you regret the necessity for so doing, and express the opinion that there is no reasonable doubt that the material exists within our own borders. If by "our own borders" you mean the State of New York, you are possibly

correct; but if by it you mean the United States, you are laboring under a mistake such as, after a quarter of a century's reading of your excellent paper, I have never before known you to fall into. Kaolin of excellent quality is found from the Valley of Virginia in the East to Arkansas in the West, and it abounds in North Carolina, Tennessee, Georgia, Alabama, and the northern portion of Mississippi, and I think that it (as well as a very superior quality of lithographic stone) has very recently been found in Kentucky. In South Carolina, kaolin is very abundant and of superior quality. During the late war, quite a large amount of table ware was made at the Kaolin Mine, as it is called, in Edgefield district (I think that is the name), some 10 miles south of Augusta, Ga. During the war, I used in my house some of the ware; and though rather roughly fashioned, it was equal in point of color and strength to any other porcelain.

Since the war, the manufacture of the ware, I think, has been abandoned; yet large quantities of the clay have been shipped (thousands of hogsheads yearly) to your own city, where, I understand, it is sold to paper makers, candy makers, and manufacturers of wall paper, as a substitute for terra alba. You will find on inquiry large stocks of it in your city, and is most likely sold as an imported article; and quite likely the "slip" alluded to in your article is from the South Carolina mines. If any of the other States have ever engaged in shipping it abroad, I am not aware of it.

Nashville, Tenn.

S. D. MORGAN.

The Steam Climber.

To the Editor of the Scientific American:

In a recent issue I find an account of a steam hill climber, as you term the new locomotive for the U. I. & E. R. R. The engine in question was built at the Mason Machine Works of this city, and was designed to run both on a level and an incline. Perceiving several errors in your short notice of it, I imagine that you will be glad to receive a few correct dimensions. The small double-flanged wheels are 27 inches in diameter, and the track they run on is 9 inches above the outer rail, which is of the usual gage. The main drivers are 3 feet 6 inches in diameter, and consequently clear their rails $\frac{1}{2}$ inch when the small ones come into play. The cast steel cog wheel is placed between the small wheels, of course on the back axle only, to which the main rod is attached; it is 8 inches wide, and its teeth have a pitch of 4 inches, while its pitch line diameter is 27 inches. You will notice that the power at the rim of the small wheels (which is also the pitch line of the gear) is much greater than at the rim of the main drivers, because of the increased leverage, which is also an advantage in climbing.

The engine is a double-truck locomotive, designed to allow each truck to swivel on its centers, similarly to the Fairlie system. There are six drivers of 3 feet 6 inches diameter, with 4 inch centers; the cylinders are 17 x 24 inches; the boiler has a fire box, 66 inches long by 48 $\frac{1}{2}$ wide, inside, with 154 two inch tubes 11 feet 6 inches long; the tank has a capacity of 2,530 gallons. The tank end is supported on a six wheeled truck, with four sliding side bearings under the frame, and is so arranged that the truck swivels on its center piece. The engine weighs about 32 tons on its drivers, and is fitted with the Walschaert valve gear, which is quite familiar to European engineers, but has not yet received the attention in this country which it deserves.

I enclose a photograph of the engine, which is appropriately named the Leviathan.

Taunton, Mass.

WM. E. SPARKS.

Dry Plate Photography.

To the Editor of the Scientific American:

No doubt many of your readers who may be interested in practical photography, particularly in preparing plates for the dry process, have often experienced difficulty in applying the preparatory coating of albumen smoothly, unless they resort to the careless general practice of first dipping the plate into water, which so largely dilutes the mixture as to seriously lessen, when it does not entirely destroy, its efficacy. The result is that, in subsequent operations, the film is liable to slip, and thus destroy the value of the negative.

For a long time I experienced much annoyance myself from this source, until I discovered that all difficulty could be obviated by simply breathing upon the plate before pouring on the albumen, when the solution will be found to flow as smoothly and evenly as the best collodion. If during the application the fluid shows any hesitation in covering a particular spot, it is only necessary to again breathe upon that point, and the difficulty will be removed.

I. HENRY WHITEHOUSE.

Ouchy Lausanne, Switzerland.

Parasites in the Tongues of Flies.

To the Editor of the Scientific American:

A few months ago, when examining with a microscope the tongues of house flies, I discovered in the tongues of several a species of worm. In some flies, I found two worms, in others one, and in others none at all.

If among your subscribers there is any microscopist who can give some information concerning these parasites, it would be interesting to many to hear from him. The worms were found about the spiral glands; they were transparent in appearance, head and tail being exactly alike. They were very active in their motions.

W. W. W.

Cincinnati, Ohio.

The Wild Sheep of California.

The California species (*ovis montana*) is a noble animal, weighing when fully grown some 350 pounds, and is well worthy the attention of wool growers as a point from which

to make a new departure. That it will breed with the domestic sheep I have not the slightest doubt, and I cordially recommend the experiment to the various wool growers' associations as one of great national importance.

The clothing of our wild sheep is composed of fine wool and coarse hair. The hairs are from about two to four inches long, mostly of a dull bluish-gray color, though varying somewhat with the seasons. In general characteristics they are closely related to the hairs of the deer and antelope, being light, spongy, and elastic, with a highly polished surface; and though somewhat ridged and spiraled, like wool they do not manifest the slightest tendency to felt or become taggy. A hair two and a half inches long, which is perhaps near the average length, will stretch about one fourth of an inch without breaking. The number of hairs growing upon a square inch is about 10,000; the number of wool fibers is about 25,000, or two and a half times that of the hairs. The wool fibers are white and glossy, and beautifully spiraled into ringlets. The average length of the staple is about an inch and a half. A fiber of this length, when growing undisturbed among the hairs, measures about an inch; hence the degree of curliness may easily be inferred.

Wild wool is too fine to stand by itself, the fibers being about as frail and invisible as the floating threads of spiders, while the hairs against which they lean stand erect like hazel wands; but notwithstanding their great dissimilarity in size and appearance, the wool and hair are forms of the same thing, modified in just that way and to just that degree that renders them most perfectly subservient to the well-being of the sheep. Furthermore, it will be observed that these wild modifications are entirely distinct from those which are brought by chance into existence, through the accidents and caprices of culture.

It is now some 3,600 years since Jacob kissed his mother and set out across the plains of Padan-aram to begin his experiments upon the flocks of his uncle, Laban; and, notwithstanding the high degree of excellence he attained as a wool grower, and the innumerable painstaking efforts subsequently made by individuals and associations in all kinds of pastures and climates, we still seem to be as far from definite and satisfactory results as we ever were. In one breed the wool is apt to wither and crinkle like hay on a sun-beaten hillside. In another, it is lodged and matted together like the lush-tangled grass of a manured meadow. In one the staple is deficient in length, in another in fineness; while in all there is a constant tendency toward disease, rendering various washings and dippings indispensable to prevent its falling out. The problem of the quality and quantity of the carcass seems to be as doubtful and as far removed from a satisfactory solution as that of the wool.

The source or sources whence the various breeds were derived is not positively known, but there can be hardly any doubt of their being descendants of the four or five wild species so generally distributed throughout the mountainous portions of the globe, the marked differences between the wild and domestic species being readily accounted for by the known variability of the animal. No other animal seems to yield so submissively to the manipulations of culture. Jacob controlled the color of his flocks merely by causing them to stare at objects of the desired hue; and possibly merinoes may have caught their wrinkles from the perplexed brows of their leaders.—John Muir in the Overland Monthly.

Colored Confectionery.

It may not be uninteresting to some of our readers to see what kind of poisons are administered in the form of colored candy to the young Hungarians at home. Professor Ballo, of Pesth, who has been analyzing them, reports that, in 13 specimens of red candy which he tested, he found that 11 were colored with cochineal and 2 with fuchsin. Of 12 blues, 2 were ultramarine, 1 indigo-carmin, 2 aniline blue, and 8 Prussian blue. Of 83 yellows, 31 were chrome yellow, 49 were Dutch pink, and 3 a salt of binitro-naphthol. Of 18 greens, 4 were Paris green, 8 chrome green, 2 ultramarine green, and 4 sap green. The so-called iron yellows were chrome yellows, and the so-called substitute for carmine was an arsenious fuchsin. Of these colors the Paris green, chrome green, and chrome yellows are poisonous; and their use should be prohibited, and so should that of fuchsin, for only the cheaper and arsenious sorts are used. The action of binitro-naphthol salts is entirely unknown, and hence their use should not yet be permitted. To make the confectionery cheaper, its weight is increased by sulphate of baryta and other adulterations.

GREAT BRITAIN AT THE CENTENNIAL.—We are glad to announce that Mr. F. R. Sandford, a gentleman of great administrative abilities, who was Secretary of the Commissioners of the London Exposition of 1862, and Mr. Philip Cunliffe Owen, who had charge of the British delegation to the recent Vienna Exposition, have been appointed to take charge of their country's interest at the approaching Centennial.

A SHAFT has been sunk at Lawton, Eng., for the purpose of pumping up brine, to be conveyed by pipes to the coke ovens in connection with a colliery, a distance of two or three miles, there to be converted into salt by means of the waste heat from the ovens. The cost of the undertaking will, it is said, exceed \$200,000.

SOME of the large sugar manufactories of Paris are now illuminated at night by the electric light obtained from the Gramme machine. The apparatus requires from 1 to 1 $\frac{1}{2}$ horse power, and is driven from the engine the same as any other piece of machinery.

A CHINESE PATENTEE.

We herewith introduce the first Chinese patentee to the American public. He is a resident of San Francisco, Cal., and his invention is a pair of overalls, the novelty of which consists in forming a gusset or triangular lap upon the piece of material which comes opposite the corner of the pocket or other termination of a seam, and then sewing the lap or gusset down across the seam.

A represents a pair of overalls. In order to fasten the corners of the pocket and the termination of other seams in the overalls, a triangular or other shaped piece of cloth, *b*, is left projecting from the piece of cloth opposite the corner of the pocket, and this small piece, *b*, is lapped over the corner of the pocket or seam, and sewn down firmly all around, so that it will form a gusset for strengthening the corners of the pocket, and prevent them from ripping or being torn by any ordinary strain that may come upon them. This piece, *b*, is formed in the proper place when cutting the cloth for the part, so that it forms a permanent part of one of the pieces of the overalls, and is, therefore, much stronger and more durable than if it were a separate piece sewn on over the seam. This form of fastening, says the inventor, also gives the overalls a much neater and more durable appearance; and the re-enforcing lap, instead of being a separate and independent piece of goods sewn to the garment, is a part and parcel of the body of the garment, and cut in one piece with it, thus not only avoiding the necessity of a separate re-enforcing piece, but also avoiding one seam, which would be necessary to secure a gusset as usually cut.

For further particulars address the inventor as above.

Sir Goldsworthy Gurney.

With regret we record the death, at the age of 82, of Sir Goldsworthy Gurney, a man of considerable eminence as an inventor. He was the son of Mr. John Gurney, of Trevorgus, in Cornwall, and was born in 1793. He was educated for the medical profession. He gave lectures on chemical science at the Surrey Institution in London. But his career was invested with peculiar interest for engineers, by his connection with steam locomotion on common roads. He constructed a little locomotive, which worked successfully with ammoniacal gas, and the results of his experiments were so satisfactory that he subsequently built a steam road carriage. In 1826 he ran this carriage several trips in the neighborhood of London, ascending Highgate Hill without difficulty. A description of this carriage will be found in the seventh edition of "Lardner on the Steam Engine," published in 1840. In 1831 a carriage built by Gurney, for Sir Charles Dance, ran regularly between Gloucester and Cheltenham, for four months, four times a day, during which time it carried about 3,000 passengers, and ran 3,564 miles. Generally the distance, nine miles, was run in 55 minutes. Gurney invented the oxyhydrogen or Bude light, so called from his Cornish residence, in 1825. He carried out several improvements in connection with his system of lighting, among which was an arrangement of reflectors for dispersing the light in gradually diverging rays from the lantern, and a ventilating chandelier, which was also so contrived as to evaporate small quantities of water for the purpose of keeping the atmosphere of the room in a salutary condition. The Bude light was tried for the first time in street illumination on the 10th of January, 1842, at the crossing in Pall Mall at the bottom of Waterloo place. It is said to have illuminated the whole of the open space in which stands the Athenaeum Club very powerfully, and to have caused the gas lamps to look as dim as at that time the old lamps at the end of Gower street did to the gas lamps when established. Gurney likewise devised the well known stove which goes by his name, and a method of mine ventilation, which consisted in taking high pressure steam down the shaft and then allowing it to escape in an upward direction through a number of jets. In his youth he was associated with Davies, Giddy, and Trevithick, and no doubt imbibed from them much of his love of mechanical science. Sir Goldsworthy Gurney was a magistrate for the counties of Devon and Cornwall.

Doing up One's House.

The principal reason, according to the *Saturday Review*, why so many people dread having their houses done up, is that the object of each tradesman employed seems to be to make work for some other tradesman. The whitewasher forgets to cover up the steel grate in the drawing room when he is doing the ceiling. The housemaid is so busy flirting with him, and listening to the words of the last comic song which he is trying to teach her, that she neglects to remove the fender and fire irons. Grate, fender, and fire irons are completely spoiled, and have to be sent away and repolished at considerable expense. The whitewasher also manages to clog the bell wires so that the bells will not ring. The bell-hanger must therefore be sent for. He leaves dirty finger marks upon the cornice where he has loosened the cranks, and round the china handles where he tries the bells. Perhaps he breaks one of the handles. It cannot be mended, so two new ones must be bought, and another tradesman brought in to put them on. The paper hanger possibly uses

bad size on the wall, and makes his paste of damaged flour; consequently, when the room is again inhabited, it has a mysterious but most offensive smell. Perhaps he does not take the trouble to remove the old paper before putting on the new one, in which case pastilles may be burnt and windows opened, but all in vain—the smell will remain. The painter does not sufficiently rub down or burn off the old paint before he puts on the new. He sometimes even covers the old doors with size to save himself trouble and make a surface. He is almost always careless with his first coat—a



CHEANG QUAN WO'S OVERALLS.

carelessness he cannot afterwards repair. It is not uncommon, as soon as the new paint is quite dry, and has been under the influence of either sunshine or a hot fire, to see it starting off in pieces at the slightest touch, and leaving the light under color visible. If not carefully watched, the painter will put his pots on one of our best tables, making on it a fine confused pattern of circles great and small. In consequence of his carelessness, the polisher has to be called in. The painter is quite satisfied, having done his part towards the encouragement of trade. In giving the hall door a fresh coat, he lets drops fall on the step which no French polisher or English housemaid could, with any quantity of fuller's earth, whiten or remove. He walks up and down the oil cloth in the hall with nailed boots, and gives it the appearance of having recently recovered from a severe attack of small pox. His sympathies are with the makers of oil cloth, not the buyers thereof, so he is rather pleased. It is not uncommon for a bill to be sent in charging for four coats of paint when only two have been put on; perhaps in some cases there may have been three thin paintings and a little chalk mixed with the white lead. Common oak varnish will be charged as best copal, and the bad cotton rope with which the window sashes are mended as best hemp line. Strange to say there are people who honestly love the house painter and his paint, who like to be constantly redecorating their rooms. Men of supposed taste still have their hall doors grained in a bad imitation of oak or maple, and prefer paint on their stairs to stained and varnished wood. The reason why builders so love paint and varnish is that it hides bad wood, and insures to them and their successors work for ever. If some substitute for whitewash on ceilings could be found which would wash, they would lose thousands a year. They set their faces against the varnished papers which some people have adopted, and which are certainly a help to cleanliness at small cost, as they bear washing. They detest marqueterie floors with rugs, as there are not then heavy carpets to take up and nail down, and tear also, as we know to our cost.

Preparation of Washing Blue.

Twenty lbs. white potato starch, twenty lbs. wheat starch, twenty lbs. Prussian blue, two lbs. indigo carmine, and two lbs. finely ground gum arabic are mixed in a trough, with the gradual addition of sufficient water to form a half fluid, homogeneous mass, which is then poured out on a board with strips tacked to the edges. It is then allowed to dry in a heated room until it does not run together again when cut. It is next cut, by a suitable cutter, into little cubes, and allowed to dry perfectly. They are finished by being placed in a revolving drum, with a suitable quantity of dry and finely pulverized Paris blue, until they have a handsome appearance. The cost is about 12 cents per lb.

The Modern War Ship.

Mr. John Scott Russell, in a recent paper before the Institution of Naval Architects, says: "My personal opinion and experience have grown steadily towards the conviction that we should consider a modern war vessel as a mere tool or instrument of destruction, not a ship (in the eyes of the sailor, quite unworthy of the name), a mere floating gun carriage, a mere floating spear propelled by steam and meant first to place an explosive shell in the enemy, and second to run in to his side and sink him. If I am right in supposing that what I say truly represents modern naval opinion, then we come to a very simple practical conclusion. Let us take one big gun, let us give it the largest bore, the largest shell, the highest penetrating speed we know how. Let the vessel herself be considered in the light merely of a floating gun carriage. Let this one large gun occupy the chief place in the vessel in front of her engines and boilers and propellers. Let it be as small a ship as is consistent with high speed, let it be propelled by high engine power, let it show very little above water, and let it have a short, strong, ugly stem to strike the enemy and sink him.

Not only high speed but admirable dexterity, and quickness of movement or manoeuvring, are indispensable to this sort of vessel; she must be low in the water, nearly unsinkable, all her decks perfectly closed, waves must break over her without harm, she must be steady, quick, and sure.

It may be said that such a ship is hard to find and hard to make and hard to handle. Certainly she is hard to work; but is not all great, noble work hard, and are not victories always hard to win?

If you agree with me in regarding this one gunboat as the type of an effective instrument of naval destruction, the next question which naturally arises is this: When we want two guns, shall we have a two-gunboat or two one-gunboats? The arguments on this point are the following: In many practical cases of experience we find it prudent to have duplicates; we may have two pumps where one would do, we may have two cylinders where one would do, two screws where one would do, two boilers where one would do. My answer is that duplicates are useful in little things; we cannot afford them in principals, though we can in subordinate things. My personal opinion is that two large guns in two small gunboats are better than two large guns in one small gunboat. To this rule, however, I know of exceptions in these two cases: the large many gunned man-of-war, with central battery and central armor coating, and the small single great gunner. I have taken extremes, because I think both of these inevitable and indispensable to England. There is a third fleet of indispensables—I mean the cruiser. She must be an ocean steamer, large, long, fast, large gunned, many gunned, long ranged, steady, easy, good sea boat, carrying large store of coal and other stores. She must have great destructive power, great endurance, great manoeuvring power, and with high speed, power to choose her own enemy, and her own time and place, and manner of action. Only she cannot be covered with armor. Also, she can, if not absolutely secured, be comparatively well protected by certain precautions which may be well considered. Let us consider these. 1. Let us put all that wants protection well under water; let us give protection by armor, if necessary, in small quantity near the midway armor line; let the whole ship be in cellular watertight divisions of content, and even somewhat inconvenient, smallness, but judiciously arranged so as to be conveniently accessible for good, and conveniently inaccessible for harm. By these and many similar precautions, which I will not here enumerate, the ocean cruiser may be made the queen of the seas.

Here then are three classes of ships or fleets about which we need be in no doubt as part of the fleet of the future.

1. *The Man-of-War*.—Large, fast, enduring, many and large guns, central battery, perfectly shot-proof, engines, boilers, and magazine perfectly protected; possessing also all the protecting precautions of the cruiser, but slower and heavier; enduring, a hard hitter, and hard to hit.

Have we a fleet of these? How many have we—want we?

2. *The Single Great Gunboat*.—Long, narrow, low, fast, quick, clever, ugly, and sharp, unsinkable. Of these we want, not a mere fleet, but a multitude, not numbers, but swarms, clouds.

Have we swarms of these?

3. *The Many Large Gunned Ocean Cruiser*.—Long, wide, deep-sided, fast, enduring, quick in her manoeuvring, with destructive power, and small protection, able to do great harm and ready to run great risks.

Have we fleets of these ready for each of the oceans in which we have colonies, and are certain to have war?

The Suez Canal.

Late reports from Egypt state that the usefulness of the Suez canal has become much impaired through the quantity of sand blown into it at certain places, and which, if not systematically removed, will soon fill it completely. Already large vessels cannot pass each other, but are compelled to wait at the mouths of the canal until the channel is clear. It is probable that high walls will eventually be built along the banks of the canal as barriers against the sand storms which are so common.

IMPROVED SHINGLE MACHINE.

We illustrate in the annexed engraving a new shingle machine, which is adapted to cutting all kinds of wood, and which can be adjusted to cut shingles of any required thickness. It is claimed to be free from the irregular and uncertain motion of the block holders and carriages, which occurs in some other machines of like nature, and also to prevent great waste of lumber. The block holders have a gradually decreasing motion when approaching the saw, and a rapid return, these movements being imparted through the eccentric gear on the right of the apparatus. The dogs are provided with blocks of wood so inserted as to project below the iron teeth. These extend downward to the upper surface of the saw, and act as a guide, preventing the saw from striking the iron and also gripping the block after it has become too thin to be held by the teeth, thereby saving much timber ordinarily wasted.

The block, by its own weight, falls into proper position for the next shingle, the accuracy of its placing not being in any wise dependent upon complicated mechanism. The side of the block is presented to the saw, which, cutting lengthwise the fibers of the wood, thus produces the shingles almost as smooth as if planed.

The apparatus represented is a double block machine having a capacity of from seventy-five to one hundred thousand shingles per day, as many as one hundred and twelve thousand have been repeatedly made, the quantity depending entirely upon the power applied, the quality of timber, and the skill of the operator.

The same manufacturers also make a single block automatic machine especially adapted to cutting up waste in lumber mills, and also an excellent hand machine suitable for persons requiring but small quantities of shingles. Besides these, a special machine is constructed for producing shingles from 20 to 24 inches in length, and also a variety of other apparatus relating to the manufacture of shingles.

The device illustrated was patented February 27, 1872. Further particulars with reference to it, or with regard to shingle machinery and manufacture, may be obtained by addressing Messrs. W. H. Hiner & Co., Union Iron Works, Fond du Lac, Wis.

IMPROVED TANNING PROCESS.

The inventor of the improved tanning process, the apparatus for which is illustrated in the annexed engraving, is a practical tanner of fifty years' experience, a circumstance which probably will be alone sufficient to commend his invention to the favorable consideration of the trade. The improvement consists in connecting the vats and suspending the hides in such a way that the old liquor from the new stock is drawn into the oldest leach. It passes through and over to the next, and so on to the last, where it enters and circulates through the oldest stock suspended for tanning, and finally returns to the starting point, thus keeping in constant circulation. At the same time the old stock is softened, scoured, and re-tanned, and the old ooze is filtered through the leaches, helping to strengthen the liquor.

It is claimed that by this means the leaching is so effectual as to extract the strength from any tanning substance, and that the bark, when placed on end, will give up its strength with less bloom and gallic acid, while the hides are excluded from the air.

The hides are first soaked in water, and, if hard and dry, are softened in the wheel, B. They are then hung lengthwise (if split they are tied together at the backs) on the rack, F, beneath the wheel, C, for liming. The paddles on wheel, C, keep the liquor in agitation, while the latter is supplied from above, through the trough, D, by means of the pump, E. The constant circulation which is thus kept up among

the hides during the liming, it is stated, greatly hastens the process. In order to remove the hair, the hides are placed within the wheel, C; and while rolling about therein, the lime liquor continues descending upon them, washing out the hair through the wheel, and carrying it against the rack beneath, where it is retained, clean and free from knots. The hides, on withdrawal, are placed in wheel, B, and there worked out ready for the tan. During the above operation, a segment of cross slats, placed between the floats on each wheel, so that the hides drop in the water as the wheel rotates.

While tanning, the hides are again suspended on racks,

from the green house, will, it is said, soon pay the cost of establishment. It is labor-saving, and produces good leather in the shortest time without necessitating material innovations upon old and well tried processes.

Patented through the Scientific American Patent Agency, January 5, 1875, to Mr. Harvey Reed, who may be addressed for further particulars, care Dr. Samuel Hape, Atlanta, Ga.

Relations between Magnetism and the Aurora.

It appears from the scientific report of the Austro-Hungarian North Polar expedition of 1872-4 that magnetic disturbances are closely connected with the aurora. While in tem-

perate zones they are the exception, they form the rule in arctic regions; at least the instruments are almost in constant action. This is the case for the inclination, declination, and intensity needles.

The magnetic disturbances in the district visited were of extraordinary frequency and magnitude. They were closely connected with the aurora borealis, the disturbances being the greater, the quicker and the more convulsive the motion of the rays of the aurora, and the more intense the prismatic colors. Quiet and regular arcs, without motion of light or radiation, exercised almost no influence upon the needles. With all disturbances the declination needle moved toward the east, and the horizontal intensity decreased, while the inclination increased. Movements in an opposite sense, which were very rare, can only be looked upon as movements of reaction. The ways and manner of the magnetic disturbances are highly interesting. While all other natural phenomena become apparent to our senses, be it to the eye, ear, or touch, this colossal natural force only shows itself by these scientific observations, and

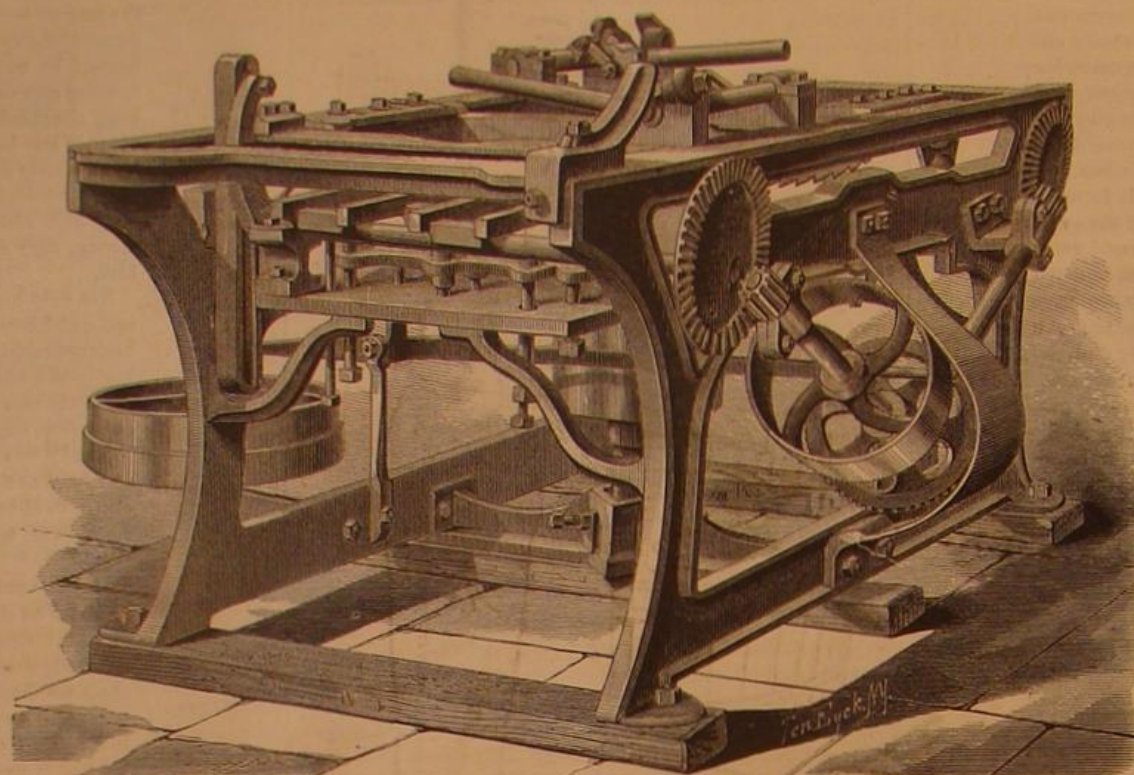
has something mysterious and fascinating on account of its effects and phenomena being generally quite hidden from our direct perception.

The instrument upon which Lieutenant Weyprecht placed the greatest expectations, namely, the earth-current galvanometer, gave no results at all, through the peculiar circumstances in which the explorers were placed. He had expected to be able to connect the aurora with the galvanic earth currents. But as the ship was lying two and a half German miles from land, he could not put the collecting plates into the ground, but was obliged to bury them in the ice. Now, as ice is no conductor, the plates were isolated, and the galvanometer needle was but little affected.

DRIFTING OF ICE.

Lieutenant Weyprecht, of the Austrian Polar expedition, made the remarkable discovery that the ice never drifted straight in the direction of the wind, but that it always deviated to the right, when looking from the center of the compass; with N.E. wind it drifts due W. instead of S.W.; with S.W. wind it drifts due E. instead of N.E.; in the same manner it drifts to the north with S.E. wind, and to the south with N.W. wind. There was no exception to this rule, which cannot be explained by currents nor by the influence of the coasts, as with these causes there would be opposite results with opposite winds. Another interesting phenomenon was the struggle between the cold northern winds and the warmer southern ones in January, just before the beginning of the lasting and severe cold; the warm S. and S.W. winds always brought great masses of snow and produced a rise in the temperature amounting to 76-95° Fah. within a few hours.

The influence of extremely low temperatures upon the human body has often been exaggerated; there are tales of difficulty in breathing, etc., that are caused by them. Lieutenant Weyprecht and his party did not notice anything of the kind; and although many of them had been born in southern climes, they all bore the cold very easily indeed; there were sailors among them who never wore fur. The cold only gets unbearable when wind is united to it.

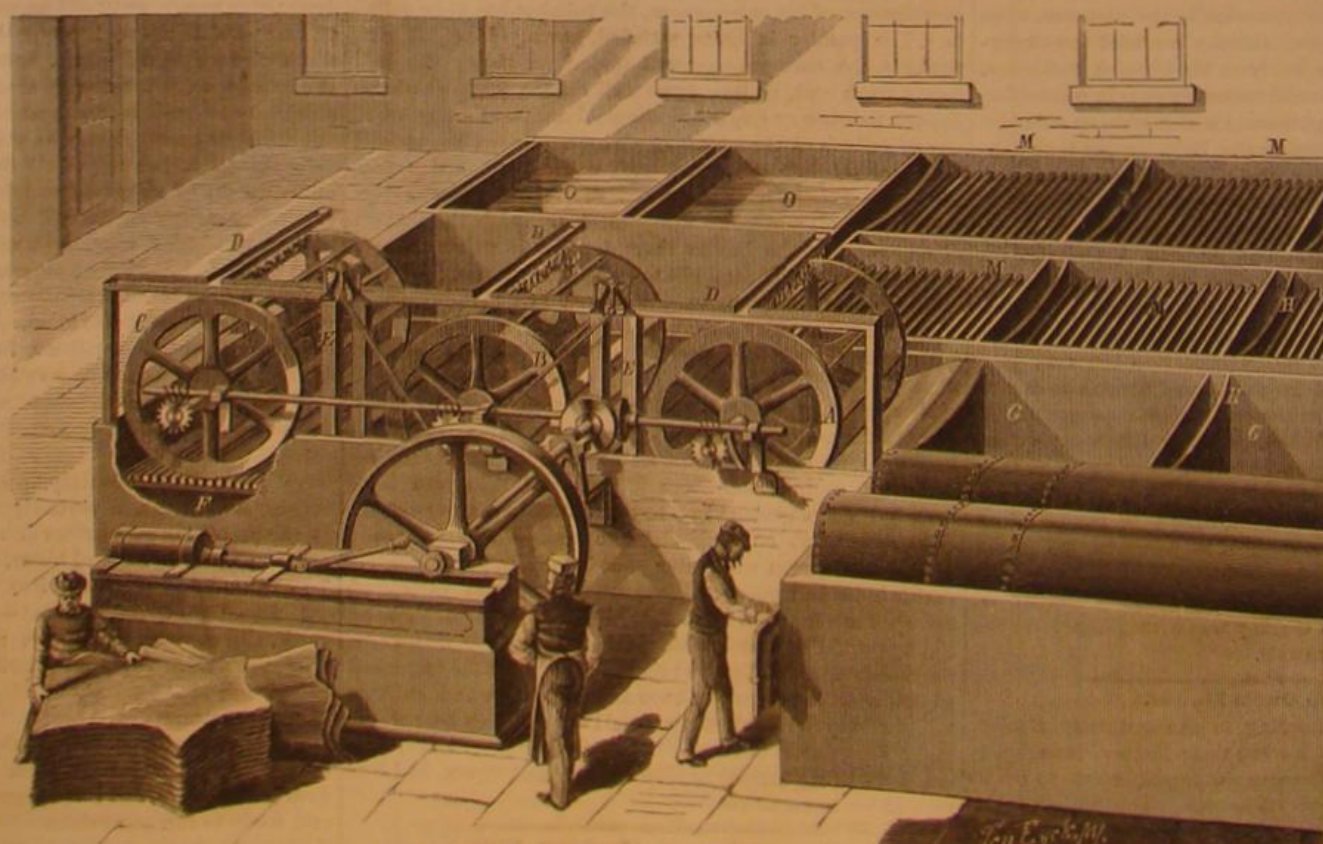


WHITE'S SHINGLE MACHINE.

M, which may be shifted along from vat to vat during the process, the partitions, H, being movable for this purpose, and also to allow the liquor to flow while passing through the series of leaches and tan vats. The weakest liquor is forced by the paddles of wheel, A, from the new hides, over into the weakest leach, G, where it passes through the false bottom, up the hollow partition, over into the next leach, and so to the last. Thence it returns, by reversing the circulation, back to the fresh pack from the green house.

The racks of tanned leather can be hoisted, as desired, directly into the loft, and others slid forward to make room for new ones. A false box, which is inserted in the weakest leach, may be lifted out and its contents discharged immediately into the wet tan furnace.

In currying, the wheel, A, will be found of much use, as



REED'S TANNING APPARATUS.

the leather, after splitting, may be placed inside, and there scoured, softened, and re-tanned, emerging with a fair grain and fine nap on the flesh side in pliable condition, susceptible to excellent finish. At the same time the old ooze is passed over and saved by filtering in the leaches. Tanned stock is greatly improved by running through the wheel, and this without the usual loss in weight.

The invention is claimed to be especially adapted to warm climates, where tan vegetation grows spontaneously. The refuse, when composted with lime, animal matter, and waste

THE SECRETARY BIRD.

Many and various are the names applied to this extraordinary bird, by the natives of the different countries in which it is common. By some it is known as the "Devil's Steed," by others as the "Bird of Fate." We must own that to us these fanciful appellations are quite unintelligible, nor has any Eastern tale that we have ever read thrown a light upon their origin; nevertheless, our unpoetical imagination at once recognizes the appropriateness of its nickname of the "Secretary," as the crest upon its head, when laid back, looks most comically like the quill pens which clerks or secretaries used sometimes to put behind their ears.

Its common name is crane vulture, while it is known to men of science as the *gypogeryx serpentarius*. The crane vulture inhabits Africa, from the Cape to 15° north latitude, and from the Red Sea to Senegal; it is also occasionally seen on the Philippine Islands. One species is also met with in Northern Africa. A glance at the engraving will show that its life must necessarily be passed almost entirely upon the ground. Its toes are short, and it can walk so fast that it is sometimes called the messenger bird. When desirous of flying, it is compelled to run a short distance and then spring upward, in order to get fairly on the wing; at first it moves heavily and with difficulty through the air, but after a few strenuous efforts its flight becomes easy and regular, and it sweeps lightly and beautifully aloft, apparently without even moving its broad pinions. It finds itself, however, most at home upon the ground, and stalks over its surface with much dignity.

About June or July furious quarrels arise among these birds relative to the choice of a mate, the disputed female becoming the prize of the most powerful of the rivals. The pair build a nest upon a high tree, using branches and twigs plastered together with clay. The shallow interior of the nest is lined with cotton, feathers, and other soft material. It is no uncommon thing for the branches, of which the outer walls are formed, to sprout afresh and spread, until the eyrie becomes literally a leafy bower of great beauty. The eggs are two or three in number, and about the same size as those of a goose, but somewhat rounder; the shell is either pure white or slightly marked with little red spots.

Snakes of all kinds are the objects of constant attack by these birds. When a serpent sees one of these dreaded enemies approaching, it will rear itself and swell and hiss in rage and fear; but the bird will spread his wings, forming with one of them a buckler in front of him, and when the reptile makes a spring at him the bird will bound about, always presenting that hard, well-protected wing; and while the serpent is vainly spending its poison on the thick bunch of feathers, the foe is inflicting heavy blows on the defenceless head with his other wing, until, stunned and faint, the venomous creature rolls on the ground; the bird then catches it and throws and dashes it about, finally killing it with his sharp bill. Then he swallows his victim with great relish, being in no way affected by the poison it contains.—*Home and School Journal of Popular Education, Louisville, Ky.*

THE WARDIAN SYSTEM OF PLANT CASES.

The ferns have long been favorite objects of cultivation by lovers of beautiful foliage, and their infinite variety makes them a never ending source of interest. A slight expense in providing the requisite glass case and a little occa-



THE SYDENHAM CASE.

sional attention will provide a very beautiful object of decoration to a home; while the tasteful selection and arrangement of the plants is a pleasing occupation for the ladies of the household.

We publish herewith three designs for fern cases, which we have selected from the *London Farmer*, and that journal gives the following principles upon which a fern case should be constructed: 1. Have no apparatus or arrangement for drainage. 2. Make your case as airtight as possible, allowing for no ventilation. These are very simple rules, and may seem to mean nothing; but they cover the whole ground, and, if you wish success to be the result of your labors, follow them.

Cases constructed on different principles from those of the Wardian case are necessary for the culture of other plants.

Why should we provide no drainage? The reason is that we have no ventilation. If we have no ventilation, or give no access to the air from outside, we keep the atmosphere in our case constantly charged with moisture, provided we water our plants well at the start. Ferns require, for their growth, shade and moisture; upon the former, in a great degree, depends the latter. A northern or eastern aspect, where the morning sun reaches the case, we think is best. As regards moisture, we have the principle of self-support in an airtight case; for if you allow the sun to reach the case for an hour or so in the morning, you will find that the moisture

while their growth is rapid. There are few of our greenhouse ferns that will not do well under this treatment; the gold and silver ferns are perhaps the exception; they do not always attain their full size and beauty in a Wardian case, but the adiantums, pteris, polypodiums, blechnums, and others do well.

In planting a case, do not place the plants too near, nor use too many of a large size, but put in a few plants and of a moderate size. Water well after setting the plants out, and shade the case for a day or two; then give it the morning sun each day for an hour or two, and your ferns will soon start. Nothing can be more interesting than to watch them—the frond pushes its head above the earth, the heat and moisture of the case have their effect, and it gradually rises and uncurls till it reaches its height, then it expands into the most beautiful and graceful of shapes; then what can exceed in delicacy and freshness this newly born part? The lycopodiums grow finely, and spread very rapidly in the case; small pieces introduced at regular intervals in the case will, in a marvelously short time, double their original size; and if the pendent roots of the creeping species are pressed well on to the surface of the earth, the spaces between the plants and ferns will soon be filled up, and a rich and delicate carpet be produced over the whole case. For climbers, nothing can give more satisfaction than *fiens stipitata*, which can be obtained at all greenhouses. The roots of this plant, which strike out at every joint, have an adhesive power, and will attach themselves firmly to the glass in the case, which renders the growth more rapid and regular. It is a very interesting plant to watch; the roots adhering to the glass allow a free use of the microscope, and the growth and circulation can be studied to great advantage from the outside of the case.

As to soil, the best mixture for the growth of ferns and lycopodiums is the following: Leaf mold, two parts; fresh sand, one part; gravel, about the size of a pea, one part; and stable manure, chopped very fine, one part. Ferns which grow naturally in dry places can be arranged on rockwork in the center of the case, if it is large enough to admit of it, and those requiring more

needful for the growth of your ferns is extracted from the earth; and when evening comes, this same moisture will condense and fall. Each day, this process of extraction and condensation takes place, and your plants flourish under a necessary and sufficient moisture. Now this being the kind of air we want, we must not, of course, ventilate our case, and allow it to escape, otherwise the dry air of our rooms

moisture should be placed nearer the sides of the case, and they will get more moisture from the glass, where it deposits in great quantities. The spores of ferns can be sown on the surface of the earth in the Wardian case, and a constant supply of young plants can, in this way, be obtained, thus enabling the student to watch them in every stage of development.

It happens that not unfrequently the larvæ of insects are introduced in the earth into the case, and hatch out under the influence of the heat. To provide against this, it will be found useful and interesting to put in a small sized toad, and insects will disappear very soon, and give no further trouble. Toads will live through the winter perfectly well in this way, and their habits can be studied; some may become aware, by trying this experiment, that the toad, although not one of the handsomest of our reptiles, is not the least interesting. Experience will teach many things that cannot be laid down as rules; let us have the result of such, and we may hope ultimately to introduce the Wardian case, which is a most interesting household object, more extensively than at present.

Remember that plants of different natures and requirements cannot be successfully grown together; any amount of management will not produce it, any more than the inhabi-



THE WARDIAN CASE AND STAND.

would enter, and the watering of the case become a necessity. This at once upsets all the benefits derived from these cases. The temperature, also, must be much more even in an airtight case than in a ventilated one, where the constant opening and shutting of doors and windows would affect it. If we have no watering to do, we have no water to run off, and consequently require no drainage in the bottom of our case. Now in this airtight principle, we get at the secret.

STOCKING AND MANAGEMENT.

In stocking Wardian cases the amateur will find that almost all ferns and mosses will do well in this case. The study of mosses will repay the lover of Nature, and nowhere can it be so successfully pursued as here, the moisture of the case always keeping them fresh and bright,



THE PRINCESS OF WALES CASE.

tant of the tropics can stand the changes of climate in the frigid zones.

Compressed Ice.

A writer in *Les Mondes* suggests that thin ice from ponds or small pieces left after cutting blocks from larger bodies of water, might be stored in a profitable manner, and at the same time its preservation ensured, by compressing it into solid blocks by means of any simple press. In localities where ice is not attainable, snow might easily be treated in the same way.

THE MODERN THEORY OF COLOR.

A LECTURE BY PRESIDENT HENRY MORTON, OF THE STEVENS INSTITUTE OF TECHNOLOGY.

In a lecture, recently delivered at the Stevens Institute of Technology, President Morton explained our perception of color in accordance with the generally received modern theories on the subject, which he illustrated by means of many ingenious and striking experiments. The following is the substance of the lecture:

Color, physically considered, is synonymous with wave-length, light being composed of minute undulations or waves, varying in length from the $\frac{1}{100,000}$ to the $\frac{1}{10,000}$ of an inch, the former being the length of the red, and the latter of the violet wave. These waves strike the eye with a velocity of 185,000 miles per second. Nearly 200,000 miles of them, therefore, enter the eye in every second; and every inch of these miles contains between 85,000 and 60,000 little waves. The whole number in a single ray is so enormous that it conveys no impression to our minds. Counting five every second, day and night, it would take about three millions of years to count what the eye receives in a single second. Yet, the eye, when perceiving colored objects, not only takes cognizance, in some mysterious way, of these rapid motions, but even distinguishes their rates of velocity. Between the rates of motion of the colors at the extremities of the spectrum, there might be an infinite number of intermediate rates, and hence of intermediate colors and shades. Evidently, however, the eye is incapable of discriminating more than a very limited number. And this brings us to the consideration of the eye itself, and the means by which we perceive color.

Fig. 1.

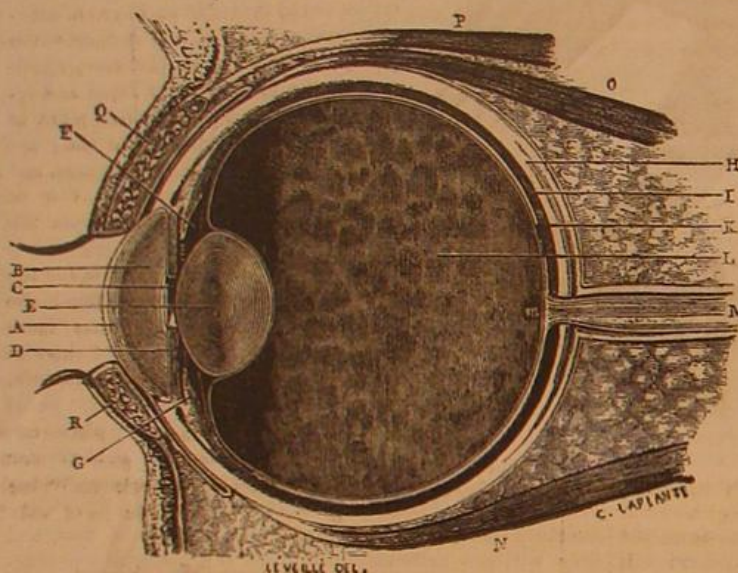


Fig. 1 exhibits the general structure of the eye. It is like a photographic camera, or dark chamber, with its lens in front and a sensitive plate behind; only, instead of being coated with collodion, the sensitive part is a hollow sphere, covered with a delicate network of nerve structure, called the retina, which it is well worth our while to examine a little more in detail.

Fig. 2.

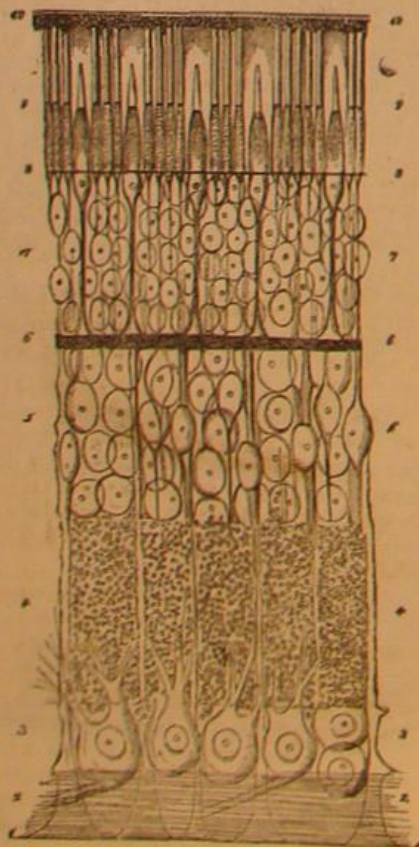
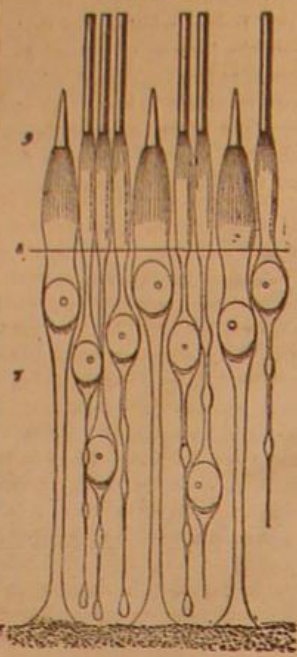


Fig. 2 shows the layers of the human retina magnified 400 times. There are no less than ten of them, all of which, with the exception of the two terminal ones, are made up of nerve tissue and connective substance. As the figure stands, the light enters from the bottom. The vibrations communicated to the nerve substance finally reach the ninth layer, where experiments, which it would take too long to describe here, have led investigators to believe that the sensation of sight is located. This layer, called the "rods and cones," from the shapes assumed by the optic nerve substance there,

is supposed to be tuned to the reception of color vibrations, just as the rods of the auditory nerve are tuned to sound vibrations. Fig. 3 gives a still more enlarged view of the rods and cones, showing their peculiar structure much more plainly. Each of them is in communication with a so-called granule, forming an enlargement which contains a nucleus. In life the granules are entirely transparent. Professor Max Schultze says: "The rods and cones must be considered the nervous terminal organs of the optic nerve; in them must take place the translation of the action of light into nervous action, which process ultimately lies at the foundation of the act of vision."

Fig. 3.



On still further magnifying these curious organs, it will be seen, from Fig. 4, that even they, minute as they are, are divided into still more minute parts. What the functions of these ultimate parts are, we cannot tell; although we have reached the extreme end of the optic nerve, and have seen its wonderful complexity, we can only reason that the conversion of light into sight must take place here; but we do not seem to have approached a knowledge of how it is accomplished by a single step. The whole subject lies far out in the *terra incognita* of Science, and it is only intended here to state the problem as it stands at present, and to show through how tangled a jungle the path of knowledge lies in this direction.

Passing now from the anatomical considerations of the subject, we will examine the theoretical view proposed by Thomas Young, and more fully developed by Helmholtz. According to this theory, the eye perceives originally but three colors or wave lengths, and all the other colors and shades known to us arise from the compounding of the primary ones in the eye. Accordingly, we assume that the eye has three sets of nerves—one affected by red, another by green, and a third by violet. In other words, the nerve for red is tuned to vibrate to red waves of light, just as a tuning fork is set in vibration by communicating with a body sounding its note; and so with the other nerves. Each of these nerves, however, is capable of being affected, though in a much inferior degree, by colors be-

longing to the others. Thus the red nerves would be somewhat sensitive to green waves, but would perceive them as a faint red. If, for example, we look at blue light, whose rate of vibration is intermediate between green and violet, it will affect the green and the violet nerves, producing a mixed impression, which we call blue. Let us try and prove this. If blue is to the eye simply the result of a combined impression of green and violet, then, by exciting both the green and violet nerves by means of the corresponding colors, we ought to get a perfect impression of blue; but if the eye recognizes blue as a distinct thing, then a mixture of green and violet light will give the impression of something not identical with blue. The lecturer then threw two disks of light on the screen, one violet and the other green; where they overlapped the result was a beautiful blue, as represented in Fig. 5.

Fig. 5.



Fig. 6.



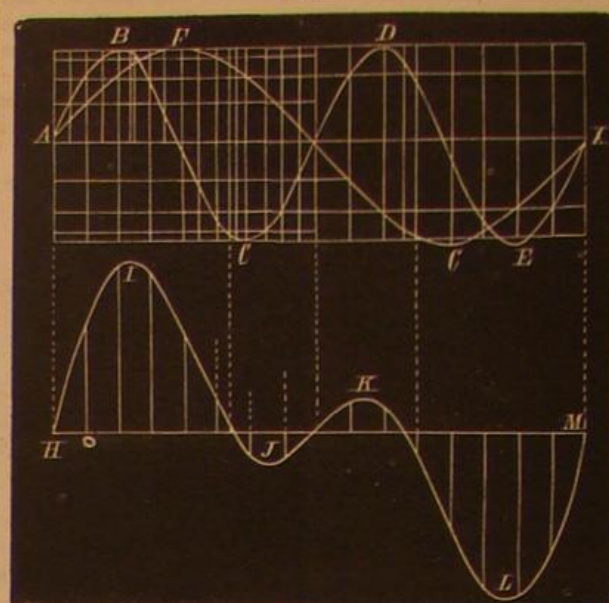
Similarly red and green disks of light, thrown on the screen, produce the compound impression we call yellow (Fig. 6).

It may be asked, however: Is not blue, being an intermediate wave length between green and violet, in fact their true average and equivalent? To show that this is not the proper manner of considering the question, it is only necessary to look at the manner in which waves combine. In the

* We are indebted to Messrs. Wm. Wood & Co. for the electrotypes of cuts Figs. 2, 3, and 4, from Stricker's great work on "Histology."

enlarging, Fig. 7, we have two waves, one twice as long as the other, and below them is their resultant, obtained as follows: Both waves, starting at A, pass up in the same direction; their combined effect is therefore equal to their sum

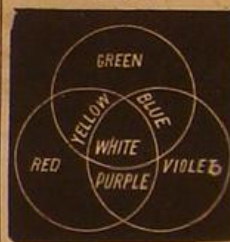
Fig. 7.



which is represented at the point, I, below; again, at the point, C, the effect of the motion of one curve below the axis, A X, is diminished by the motion of the other above the axis; the resultant point being their difference in height, and on the same side of the axis as the greater. This point is represented at J. By combining, in like manner, all the corresponding points of the two curves, the resultant curve, given below, will be produced, and this curve certainly does not look like the average wave of the two, being, in fact, a very different kind of motion from either of its constituents.

But, to follow out the consequences of Young's theory, although white light, as we know from the prism, is composed of all colors, the eye directly perceives but three of them. Therefore if we take these three colors and present them at once to the eye, the effect ought to be white.

Fig. 8.



The lecturer then threw on the screen disks of green, red, and violet, by means of three lanterns. Where all three overlapped, the result was white; where red and green combined, the result was yellow; and where green and violet combined, the result was blue; thus satisfying the requirements of Young's theory (Fig. 8).

The lecturer then proceeded to prove these important results by other means. When an image is presented quickly to the eye and then withdrawn, the eye retains the impression for a short time after the actual image has ceased to exist on the retina. This is the phenomenon known among physicists by the name of persistence of vision. To illustrate this property, which was soon to be employed in elucidating the theory of colors, a series of dots, moving forward and back like shuttles, was thrown on the screen. As the velocity of their motion was increased, the impression made by each of them, at every part of its course, remained on the retina long enough to allow it to come around again and refresh the memory, thus seeming to describe continuous wreaths of light. A very beautiful effect was produced on the same principle by having a large revolving disk, with globes in different positions with regard to hoops painted upon it, illuminated with flashes of intermittent light produced by revolving before the source of light a disk of pasteboard with a number of slits cut radially on it. The large disk seemed to stand still and the balls to roll through the hoops with great rapidity.



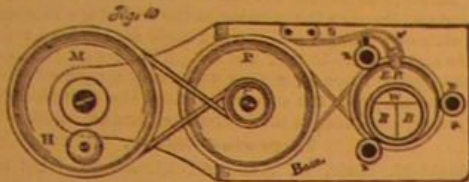
Fig. 9.

The principle of the persistence of vision may be applied to obtaining the blending of colors upon the retina, by presenting them in quick succession to the eye. Professor Rood's chromatope is an instrument for effecting this. It consists of a disk of glass, clear at the center, opaque in the shaded parts, and colored green and violet, as indicated by the letters in Fig. 9. On revolving this disk rapidly, there was an outer zone of green and an inner zone of violet; but between them, where, by its revolution, green and violet are presented successively, the impression of green remained long enough for that of violet to combine with it in the eye and

to produce a zone of blue. Disks with other combinations of colors were also shown.

The most striking effect of the lecture, however, was produced by means of a very ingenious invention of Professor Morton. He calls it the "chameleon top," and its construction is well worth studying. An opaque disk, with W (Fig. 10) for a center, is made to revolve before a lantern by means of the large pulleys, M and P. It has no axle, but is in friction gearing with the little pulleys, x x x. In this opaque disk, there is a transparent one, W R B, composed of seg-

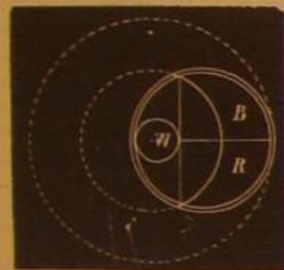
Fig. 10.



ments of white, red, and blue glass, as shown in the engraving. The transparent disk, moreover, is set in the other one loosely, so that its motion may be suddenly checked by means of an elastic pad, E P, while the large disk is in full revolution. By this means the center is shifted from one color to another. Now let us see the result of that. When the instrument is at rest, nothing appears upon the screen, except a very unpromising disk divided into three portions. But the moment it begins to revolve, the colors blend in various ways, forming rings of ever changing hues, which succeed each other like those of the most gorgeous pinwheels of pyrotechnics. Suppose the disk revolves with its center in the white, then the blending of colors in each zone can be studied from the circles of Fig. 11; Fig. 12 represents the

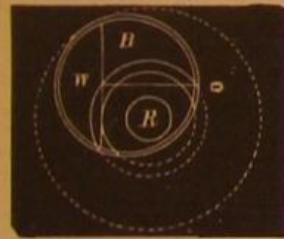
Fig. 11.

Fig. 12.



effect when the center is changed to blue, and Fig. 13, when it is shifted into the red. The dotted portions of the zones are those seen by persistence of vision. Now, by means of rapidly pressing the elastic pad against the projecting rim of the transparent disk, there is a constant shifting of centers, and the result is an infinite variety of splendid effects.

Fig. 13.



There is still another way of proving the theory of color. By throwing on the screen the intense light obtained by burning mercury, and by burning steel in the electric arch, the eye does not distinguish them; but by passing these lights through a prism, they are proved to contain very different elements. In fact, it would be all the same to the eye, if only the three primary colors existed and no others, for the result would be the same; when combined they would form white light.

Now, how do we know that the primary colors are red, green and violet, and not red, yellow, and blue, as we were taught years ago, and as Sir David Brewster maintained? An experiment will answer this question. If red, yellow, and blue are the primary colors, then green must be a mixture of yellow and blue. According to Young's theory, however, yellow and blue are equivalent to white; because by them we excite all the nerves, yellow being equal to red and green, and blue being equal to green and violet. If Brewster is right, blue and yellow light will make green; if Young is right, they will make white. The lecturer then threw the two colors from two lanterns on the screen by means of colored glasses. The result was white. The same result was obtained with the chromatope.

How does it come, then, that blue and yellow paints mixed produce green, as every child knows?

The color of paints is due to the light passing through them to the paper and reflected from the paper under them. Now, white light passing through blue paint is robbed of every color except blue, green and violet; passing through yellow paint, it is robbed of all but yellow, red, orange, and green. Green, therefore, is evidently the only color that both are agreed in transmitting through them. The same effect is produced by taking the very glasses, blue and yellow, whose combination just produced white, and allowing the same white light to pass through both, instead of having separate sources of light. The result is green, because the combined glasses cut off every other color.

There is another property of the eye with regard to the perception of color, which must not be overlooked. Like all other organs of the body, the eye is easily fatigued. If we look at red light for a long time, the nerves vibrating with it become so tired that they cease to act; if now the red is suddenly withdrawn and white substituted, the other two sets of nerves, namely, the green and violet, either act alone or are but faintly seconded by the red; and the consequence is we do not see white at all, but a shade of green. This was strikingly shown by an experiment. Two lanterns, side by side, threw on the screen, one pure white light, and the other red. After the audience had looked at it awhile, Profes-

sor Morton placed himself in such a position as to cast two shadows on the screen; one of them was red, of course, but where only white light fell the shadow was blue green. On substituting green light for the red, the shadow falling on the white part of the screen looked red. This is the principle of contrast in color, which many an artist has no doubt carried out in practice without suspecting the cause. As an illustration of a well known effect of contrast, the Professor threw on the screen a piece of statuary, and then gave it a background of green foliage by means of another lantern, the effect of which was to endue the statue with a warm tint of red.

In conclusion, the lecturer remarked that he did not wish to convey a false impression when speaking of certain imperfections of the eye. "Helmholtz, one of the most eminent physicists of the day, has used an expression with reference to the subject, which, when quoted alone, without the general spirit of the context, might convey the idea that he considers the eye as a bungling piece of workmanship unworthy of any skillful optician. Any candid reader who peruses the whole article will find that this is as far from the meaning of the author as it is from the fact. Discrimination between wave lengths is not only not the true office of the eye, but would be quite inconsistent with its varied and indispensable functions as an organ of vision. It is perfectly true that the eye, as a spectroscopic, is a very poor instrument; but who, when gazing at the glories of a crimson sunset, at the beauties of a variegated landscape, or the blended roses and lilies of a pretty face, would exchange his eyes for a pair of the finest spectroscopes that ever left the shop of the most skillful physicist?" C.F.K.

How American Workmen Live.

A recent annual report of the Massachusetts Bureau of Statistics contains some interesting facts touching the wages and manner of living of working people in that State. It may be assumed we think, that in no State of the American Union is the average situation of the working man any better, but, if any different, will be found rather below than above that of Massachusetts.

The statistics, upon which the facts given are based, were gathered by personal visits of the Bureau officers in all parts of the State, and were obtained from the workmen in all branches of skilled and unskilled labor. Complete returns were obtained from 397 families, and the condition of this number is presented in detail, as shown in the following example:

CARPENTER.

Annual earnings of father (American), \$760, being an average of \$2.43 cents per diem, paper currency.

Condition: Family numbers five, parents and three children from three to ten years of age; two go to school. Have a tenement of five rooms located in a good neighborhood with pleasant surroundings. The rooms are well furnished and the parlor carpeted. Have a sewing machine. The family dresses well.

Food: Breakfast, hot biscuit, butter, meat or eggs, cake and tea; dinner, bread, butter, meat, potatoes, vegetables, pie; supper, bread, butter, sauce, cake, and tea.

Rent.....	\$132.00	Fish.....	\$10.00
Fuel.....	37.00	Milk.....	17.90
Groceries.....	346.22	Boots and shoes.	26.30
Meat.....	89.50	Clothing.....	50.00
Dry goods.....	19.84	Religion.....	10.00
Papers.....	8.00	Sundries.....	13.24
Cost of living.....			760

All of the statements are presented with this same detail, and give a picture of the home economies of the State that is both interesting and instructive to all wage laborers. By these statements it is shown that five families out of 397 invested in furniture and carpets; 264 families, or 66+ per cent of the whole number, expended an average of \$9 yearly for books and newspapers; 34 per cent paid society dues, and the same percentage devoted money to religion. Of the 397 families, 11+ per cent have pianos or cabinet organs; 34+ per cent have sewing machines, and, in addition to this labor-saving article, many possessed wringing machines, as will be found by reference to the family statements; 53+ per cent had one or more carpeted rooms, in many instances, as stated in the individual presentations, the entire tenement of five or six apartments being carpeted; 26+ per cent paid rates for church pews.

Of the 142 families in which the father was the only worker, the average income was \$723.82. Of the 255 families in which the wives or children assisted, the average income was \$784.38. The average income of the families of skilled laborers (including overseers) was \$823.60, while of unskilled laborers' families \$687.05 formed the average income; and of the total expenditure of the 397 families, 58 per cent was required for subsistence, 14 per cent for clothing, 16 per cent for rent, 6 per cent for fuel, and the balance of 6 per cent was devoted to sundry expenses.

From the statements and tabulated returns, the Bureau has drawn the following conclusions:

As regards earnings: That in the majority of cases working men in the Commonwealth do not support their families by their individual earnings alone; that the amount of earnings contributed by wives, generally speaking, is so small that they would save more by staying at home than they gain by outside labor; that fathers rely, or are forced to depend, upon their children for from one fourth to one third of the entire family earnings; that children under 15 years of age supply, by their labor, from one eighth to one sixth of the total family earnings.

As regards expenses: That, judging from the proportionate outlay for dress, as regards entire expenses, there is no

evidence that the working men we visited, in obedience to fashion, indulge in an excessive or disproportionate expenditure; that, from our investigations, we find no evidence or indication that working men spend large sums of money extravagantly or for bad habits; that, as regards subsistence, rents, and fuel, the working men's families which we visited paid therefor larger percentages of their income than do working men's families, with like incomes, in Prussia and other European countries; and that, as regards clothing and sundry expenses, our working men's families paid therefor smaller percentages of their income than do working men's families, with like incomes, in the countries mentioned above.

As regards manner of living: That, among the families visited, those containing the greatest number of child workers occupy the most crowded rooms and the inferior class of tenements; that about three quarters of the working men's homes which we visited are in good condition as regards locality and needful sanitary provisions, but that nearly one half of the unskilled laborers live in the inferior tenements; that the working classes of Massachusetts, judging from our investigations, are well fed; that, as far as our investigations extended, our working men are, on the average, well and comfortably clothed; that their manner of dress is, at least, capable of most favorable comparison with that in foreign countries; that a large proportion of the skilled working men visited have sewing and other labor-saving machines in use in their families; and that, as evidences of material prosperity to a certain extent, significant numbers of the families, the aid of child labor being fully allowed, own pianos or cabinet organs, have carpeted rooms, and maintain pews in church.

As regards savings: That more than one half of the families visited save money; less than one tenth are in debt, and the remainder make both ends meet; that without children's assistance, other things remaining equal, the majority of these families would be in poverty or debt; that savings, by families and fathers alone, are made in every branch of occupation investigated; but that in only a few cases is there evidence of the possibility of acquiring a competence, and in those cases it would be the result of assisted or family labor; that the higher the income, generally speaking, the greater the saving, actually and proportionately; that the average saving is about three per cent of the earnings, and that, while the houses of the working men visited compare most favorably with those in foreign countries and other States of the Union, yet in certain of the United States working men have better opportunities for acquiring homes of their own.

From these conclusions, it is asserted that, while the wage system enables a minority of the working men to maintain themselves and families comfortably by their individual exertions, in a majority of cases they have to have aid from wife or children to accomplish this result.

Pneumatic Railway Signals.

At Wilmington, Del., the Philadelphia, Wilmington and Baltimore Railroad Company has recently put down, on trial, a new railway signal and gate system. Along or between the tracks, or under the road, a pipe is laid, 2 inches in diameter, in which compressed air, 85 lbs. to the inch pressure, is carried. When the train moves out of the depot, the locomotive strikes a lever; and at the first street which the track crosses, a gong or bell is set ringing, to warn persons that a train is approaching, and a gate extending across the street descends to within two feet of the ground. The gate remains closed until the train has passed. The locomotive then strikes another lever, when another bell is rung, and another gate a square ahead is closed; and the gate behind the train is caused to rise to its place, and that crossing is left free. In this manner every train that passes through a city is made automatically to fence itself in, as it were, by closing and opening gates over each street, one or two squares in advance as may be desired.

When the train starts, by its striking the lever already described, a danger signal is instantly thrown around at right angles to the track behind the train, and another a mile ahead of it. When this one is reached another lever is struck, and the last mentioned signals are thrown back to their former positions, showing the first mile to be clear; and the two other signals, one behind and one a mile ahead of the train, are exposed, and so from mile to mile along the whole road. At every point of its progress a train is thus between two signals, one to warn trains coming toward it, the other to warn trains following it.

The Way to Get Along.

Twenty clerks in a store, twenty hands in a printing office, twenty apprentices in a shipyard, twenty young men in a village—all want to get along in the world, and expect to do so. One of the clerks will become a partner, and make a fortune; one of the compositors will own a newspaper, and become an influential citizen; one of the apprentices will become a master builder; one of the young villagers will get a handsome farm, and live like a patriarch—but which one is the lucky individual? Lucky? There is no luck about it. The thing is almost as certain as the rule of three. The young fellow who will distance his competitors is he who masters his business, who preserves his integrity, who lives cleanly and purely, who devotes his leisure to the acquisition of knowledge, who gains friends by deserving them, and who saves spare money. There are some ways to fortune shorter than this old, dusty highway; but the staunch men of the community, the men who achieve something really worth having, good fortune, good name, and serene old age, all go in this hard, dirty road.—*Exchange.*

DECISIONS OF THE COURTS.

Supreme Court of the United States.

In equity.—Appeal from the Circuit Court of the United States for the Southern District of Ohio.—October Term, 1874.

HENRY J. REEDY, APPELLANT, vs. GEORGE SCOTT.

Mr. Justice Clifford delivered the opinion of the court: The surrender of a patent to the Commissioner is an act which, in judgment of law, extinguishes it. It is a legal cancellation of it; and hence the patent can no more be the foundation for the assertion of a right, after the surrender, than could an act of Congress which has been repealed; and it has frequently been determined that suits pending which rest upon an act of Congress fall with the repeal of it. Antecedent suits depend upon the patent existing at the time they were commenced, and unless it exists and is in force at the time of the trial and judgment, the suits fail.

Where a suit in equity under a patent is pending at the time of the repeal, a supplemental bill setting up the renewed patent is not a proper pleading to revive such a suit, as nothing can be recovered, either as damages or profits, for the infringement of the surrendered patent.

The infringement of the renewed patent becomes a new cause of action, for which, in the absence of any agreement or implied acquiescence of the respondent, no remedy can be had except by the commencement of a new suit.

But where the complainant, having renewed his patent pending a suit, sets up this fact in a supplemental bill, all the proofs in the case being taken thereafter, and neither the respondent nor the court below made any objection to the irregularity of the pleadings, the irregularity was also disregarded by the court on appeal.

Where the defence against a renewed patent is that it is for a different invention from the original, it cannot be doubted that the latter may be the subject of reference, as to a repealed statute, to aid in the construction of the new patent issued upon the corrected specification.

(George E. Pugh for appellant.
No counsel appeared for respondent.)

Recent American and Foreign Patents.

Improved Electro-Magnet.

Mark A. Rice, Pentwater, Mich.—This invention consists of making a number of electro-magnets with one coil, by introducing any part of each of several bars into a coil of insulated wire while other portions are outside of the coil. One leg of each of several U-shaped bars will be in the coil, and the other legs out along the exterior, or the wire may be coiled around the parts which connect the legs, leaving the two legs out, so that they project radially from the ends of the coil. By this plan each magnet is obtained nearly as strong as it would be if the others were not included, and a much greater magnetic force from a given coil or given force, with less battery, power is produced.

Improved Apparatus for Cutting Goods on Bias.

Salomon Mayer, New York city.—This invention consists of a table with one or more knife-grinding bias slots, in connection with an adjustable treadle-acted clamp piece and adjustable gage pieces, which are set to the required width and angle of the bias strips, for cutting a suitable number of layers at the same time.

Improved Medicated Beer.

Robert W. Tavenner, Bay City, Mich.—The invention consists in a novel method of preparing beer so as to deprive it of its intoxicating property, while its tonic and curative character is preserved in its integrity. It is thus made especially soothing to the nervous system, toning it up and eradicating neuralgic tendencies, while the blood is gradually purified and enabled to perform its normal functions with regularity and efficiency.

Improved Method of Bleaching Cane Juice.

John M. Lescafe, Paincourtville, La.—This invention relates to certain improvements in apparatus for bleaching sugar cane juice, and it consists in a vertical box or tank divided into compartments by means of shelves, in combination with a vertical revolving shaft provided with spirally arranged wings revolving in said compartments and alternating with the shelves. The juice is admitted to the tank from the top, and, falling upon the revolving wings, is dispersed by centrifugal force in the form of a spray through the decolorizing sulphurous acid with which the tank is filled; and being collected upon the sides of the tank and top of the first shelf, it trickles to a central opening in said shelf, and drops upon the revolving wings in the second compartment for a repetition of the dispersing process. Any number of compartments with the shelves and alternating revolving wings can be used that may be desirable to wholly decolorize the juice. The spiral arrangement of the wings upon the revolving shaft induces a current of sulphurous acid from the generator, and the said gas is forced directly upward through the falling spray of the juice, thereby securing the most thorough impregnation of the juice with the gas, and consequently the most perfect bleaching.

Improved Door Check.

D. Gundelfinger, Jefferson City, Mo.—The invention relates to the means patented by the above, October 13, 1874, to prevent the door knob from striking the wall paper, and consists in a novel construction of the slide and case, and in placing an adjustable stop over the short arm of the lever.

Improved Shoe Brush.

Andrew McElrath, 121 Duane Street, New York city.—This is a blacking brush provided with circular cavities, connected by a groove, to receive the implements required in the operation of polishing boots or shoes. A lid or cover is secured to the back of the brush by hinges, and, when closed, by a locking catch and spring. The back is provided at its respective ends with deep circular cavities, to receive and hold the wetting brush and blacking box, the handle of the former resting in the groove joining said cavities. A shoe horn is placed beneath the box, and its handle, which has a cleaning brush, also projects into the same groove. A groove is also formed on each side of said central groove, one to receive a button hook, the other a cleaning tool. A plush hat brush is applied to the outer side, and a mirror to the inner side of the lid.

Improved Railroad Signal.

Colonel Robert L. Kilpatrick, Springfield, O.—The invention consists in the use of a double treadle with clutch mechanism, so that the bell is struck or other alarm given simultaneously with the display of the signal whenever a train is approaching the station. When, however, the train is going from the station, the treadle is rendered automatically inoperative.

Improved Combined Potato Digger and Cultivator.

Henry W. King, Canaan, N. Y.—This invention relates to certain improvements in potato diggers, and it consists in the combination of a series of S-shaped revolving digging fingers, with a second series of clearing fingers, and a pivoted inclined shaker table consisting of slats: the said digging fingers lifting the potatoes and dirt from the hill, and the clearing fingers passing between the diggers and transferring the potatoes and disintegrated clods to the inclined table, which, being agitated by the unevenness of the ground, allows the dirt to pass through the slats and the potatoes to be delivered at the rear of the table. It also consists in the peculiar construction of the digging and clearing fingers, and in the devices for throwing the operating mechanism in and out of gear.

Improved Boot and Shoe.

Wm. Myer and Henry Freiburg, Quincy, Ill.—This invention relates to certain improvements in boots and shoes, and it consists in a wooden heel and shank whose upper surface forms a part of the bottom of the shoe, the upper and counter being attached to the outer surface of the shank, and in a groove around the heel, and the whole secured and combined with an outer sole which extends the whole length of the shoe and covers both the sole and shank. The said outer sole extends also around the groove in the heel to protect the edge of the counter, and, while adding to the strength of the shoe, adapts the same to receive a superior finish.

Improved Awl.

Sylvester A. Smith, Muscatine, Iowa.—The invention consists in a shoemaker's awl so constructed as to render entirely unnecessary the bristle usually employed on one end of the waxed thread. This is accomplished by making notches in the awl near the end, said notches being reversely inclined.

Improved Revolving Fly Brush.

John Gillford and John M. Hoffman, Spruce Hill, Pa.—This invention relates to certain improvements in fly brushes. It consists in a clock spring and spur gear contained within a suitable case, which may be mounted upon legs or a pedestal, according to the character of the work to be performed, the said gearing meshing with a pinion upon a vertical shaft journaled in bearings in the casing. A vertically adjustable sleeve of peculiar construction revolves with the vertical revolving shaft, and is held in position by a locking stud that engages with notches in the said shaft. In said sleeve are detachably fastened radial arms of peculiar construction which carry brushes that, in revolving, act as a noiseless escape-ment for the clock gearing; and the revolving shaft is provided with a binding screw and spring, which operate as a brake to regulate the speed of the brushes.

Improved Bath Tub.

Asa C. Brownell, Brooklyn, N. Y.—This invention relates to certain improvements in bath tubs; and it consists in the peculiar arrangement of parts whereby is constructed a combined plunge and sitz or foot bath in one and the same frame; and it further consists in the combination with the two compartments of the tub of a single overflow pipe.

Improved Ice Pitcher.

Louis Evans, Pittsburgh, Pa.—This invention relates to certain improvements in ice pitchers; and it consists in the combination with the pitcher of an inner casing to contain ice, having a detachable perforated cup in the bottom thereof, containing filtering material which eliminates the dregs and sediment from the ice, and leaves the water to be used perfectly pure and clean.

Improved Magazine Fire Arm.

Reuben S. Chaffee, Springfield, Ill.—This invention consists of a hollow metal stock, in which revolves on journals the magazine containing tubes, in each of which is contained a cartridge driver, which is held in position by notched openings in the tubes. At the back end of the magazine are pins, corresponding in number to the tubes, for revolving the magazine. Below the magazine lies the loading bar, on which are ranged lugs, for carrying the cartridge drivers forward. At the back end of the loading bar is a stop plate, in which is a spring cam. These, with the pins, both permit and stop the revolving of the magazine. A hook on the loading bar communicates with the breech block, and imparts its motion to the loading bar. On the under side of the gun is the breech block, to the front of which is attached a finger to hold the cartridge in position as it is moved forward. Above this, in a closed space in front of the magazine, is the cut-off, with spring, for forcing the cartridge forward of the breech block.

Improved Cotton Cleaner.

George W. McCauley, Pleasant Plains, Ark., and Wm. L. Crowson, Memphis, Tenn.—The invention consists in the improvement of cotton cleaners by combining with a thresher a suction fan, so arranged as to draw air in at one part of the machine, take all the dust and light impurities from the cotton as it is thrashed, and discharge it on the outside of the gin house.

Improved Table Slide.

James O. Frost, Towanda, Pa.—This invention relates to certain improvements in extension table slides, and it consists in a plate having hook-shaped extremities which grasp the frame pieces, an extension or tongue in between the hooks, which moves in a groove in the frame pieces, and a dovetail extension upon the outside, which forms a rigid connection for the plate to the frame pieces without the use of screws.

Improved Wagon End Gate.

Samuel C. Myers, Pana, Ill.—This invention consists of an end gate, which is attached to the body by a lateral spring bar with end catches that lock into a recess of the side board, and a recess of an outer gate hinged to the opposite side board. The end gate is quickly taken off by pressing the spring catch back and swinging the side gate into open position, which allows the ready detaching of the end gate from the opposite side board.

Improved Revolving Rack for Holding Stockings.

Daniel K. Wertman, Shenandoah, Pa.—This is an improved device for suspending socks, stockings, or other goods from a revolving rack, which revolves on an iron pin in the base, and stands on the counter, or in any suitable position, for exhibiting the goods.

Improved Brick Machine.

Edward Desher, Allentown, Pa.—This machine is made double, or to turn out brick from each side, the grinding and tempering mills and the brick molds being duplicates of each other. The parts of the machine are supported by a properly constructed frame, in the two end portions of which frame the clay is ground, elevated, and tempered, and delivered into the pressing cylinder, which latter is supported by the central frame. A bar scrapes the bricks from the ends of the plungers as the mold recedes, and leaves them on the brick board. The plungers are carried back and forth by the mold plate, and form the bottoms of the molds when the clay is pressed into them.

Improved Mill Spindle.

William Elliot, Williamsford, Canada.—This is an improved device for suspending the millstone above the water wheel shaft without raising and lowering the wheel with it, so that the adjustment of the upper stone to the exact position required for grinding it may be readily accomplished, and a perfectly horizontal position and smoother running of the stones obtained.

Improved Dental Plate.

Jonathan N. Clark, Bradford, Vt.—This consists of a wedge-shaped rim of soft rubber on the inner edge of the plate, forming a cushion against the gum while preserving a perfect vacuum.

Improved Cultivator.

Perry F. Landphere, Mazon, (Morris P. O.,) Ill., assignor to himself and DeWitt Jones, same place.—This cultivator cultivates two rows at a time, and can be readily adjusted to cultivate a single row, or may be used as one or two single row cultivators.

Improved Lamp Burner.

James Curzon, Darien, Conn.—The flat wick tubes are arranged at the base in two parallel planes, so that the tubes may be raised and lowered by straight parallel ratchets. The tubes twist from the ratchets upward to the top, so that they are radial to a common center thereat, and thus expose both the wide sides of all the flames to view. The filling tube is provided with a spring-closing valve, to be opened by pressure on it by the nozzle of the can, and to close self-actingly when the nozzle is taken away.

Improved Organ-Stop Action.

Frederick M. Brush, Potsdam, N. Y.—The stops are arranged to be pushed out or pulled in by hand, in the usual way, and, besides, are provided with a lug on two sides, to be acted on by the arms of the shaft to be pushed in, and by the arms of the shaft to be pushed out. The pedal may be arranged to be worked by the feet, hands, or knees, as preferred.

Improved Adjustable Reclining Lounge.

Emil Bartels, New York city.—By means of this invention, the head of a sofa or lounge may be easily and quickly adjusted to any desired inclination; and, when fixed, the same is held securely in place.

Improved Green Corn Cutter.

William J. Potter, Mount Lebanon, N. Y., assignor to himself and Robert M. Wagen, same place.—Each pair of knives is attached to an adjustable frame, and the frames are placed at right angles with each other. The two knives of each pair form an oval opening. These openings are placed at any angle with each other which will allow the knives to cut all the corn from the cob. The knives are gaged to split the kernels; the first pair cut less than the next, while the last pair cut the kernels clean from the cob, and the cob is forced out through the opening at the end of the machines. The inner ends of a plunger and rod are made concave, to enable them to embrace the butt of the ear. The ears of corn are fed in by hand, one or more at a time, and every stroke of the plunger cleans the corn from the cob and divides the kernels into two or more pieces, according as the knives may be graduated.

Improved Skate.

Reginald H. Earle, St. John, Newfoundland.—This invention simplifies the construction of the skate for which letters patent were granted to the same inventor, September 15, 1874, to enable it to be applied to any kind of a boot or shoe. By turning the screws, arms may be moved out and in, to adjust them to the width of the boot sole to which the skate is to be attached; and by moving a plate forward the arms will be moved inward, to clasp the edges of the boot sole and secure the skate to it. By moving the long arm of a lever outward, the sliding plate is moved forward, which releases the skate from the boot; and by moving the long arm of the said lever inward, the sliding plate is moved to the rearward, clamping the skate to the boot.

Improved Dumping Car.

Robert Roberts, Pattenburg, assignor of one half his right to Nathan S. Wyckoff, Clinton, N. J.—To the frame is attached a block, upon which the forward end of the car body rests, and to which it is secured while being filled and moved. The body of the car, a little in the rear of its center, is attached to a cross plate, to the under side of which are attached lugs in which work journals on a cross head of a bolt. The bolt passes down through a hole in the center of a washer and in the center of the circular recess in a plate, and through a tubular projection formed upon the lower side of the plate. The car body is turned when it is desired to dump the load at the side of the car, and a guard block keeps the said car body steady while being turned. The tail board is secured, when closed, by a drop bolt, which slides up and down in keepers attached to said tail board, and is pivoted to a lever which is pivoted to the tail board. The free end of the lever raises the bolt and unfastens the tail board, when it will be pushed out of the way by the load as it slides from the car body. The tail board may be raised out of the way, for convenience in loading the car, by swinging it either inward or outward into a horizontal position, and then sliding the upper arms of U straps along the suspending keepers.

Improved Gas Engine.

Pedro Vera, Bogota, United States of Colombia.—This is a hollow cylinder, hermetically closed, having pipes connecting it with pumps for introducing air, and a pipe for exhausting it, and containing a strong hollow gun cylinder, divided at the middle by a strong partition and open at each end, the partition having a hole through its center through which a long piston rod carrying a disk, so arranged that the ends of said gun cylinder will be alternately closed and opened as it moves forward and back. The apparatus being arranged, a certain quantity of mixed hydrogen and oxygen gases, in the proportion of two atoms of the former and one of the latter—the quantities for forming water—will flow into one of the gun chambers. At the same time, a current of electricity will be caused to enter the gun chamber, into which the gas flows, by the wire of said chamber being brought into contact with the wire of an electric machine to ignite and explode the mixture by a spark, and form water. By the heat generated in the chemical action, the water produced will be instantaneously converted into steam, which will force the piston from the gun chamber last exploded, so as to change the valves and the wire connections, and cause the action to be repeated in the other chamber, and so on. At each stroke of the piston a quantity of air will be introduced into the cylinder by the pumps, which will be heated by the heat evolved by the chemical action and expanded so that it can be utilized as a motive power, being conducted to the engine.

Improved Car Coupling.

William Green, Hyde, England.—Two laterally swinging hooks are supported by rear springs and pivoted on pins attached to the cars. To the pivoted pins is attached a lever by intervening rods. A pin holds the rod rigidly to the hook. An automatic spring coupling is thus produced, which may be uncoupled by one of the levers.

Improved Compress.

Auguste A. Lelièvre, Chatou, near Paris, France.—This consists in arranging between two wadding sheets a layer of mucilage made of Irish moss. The whole is, by desiccation, transformed into a sort of pasteboard, which can be cut out by means of scissors into square, rectangular, or other bands. This compress is liable to readily be softened by water being applied thereto, and yet preserve its mucilage. It can be used as an advantageous substitute for the poultice, the compress linen and binding bands being employed as usual.

Improved Needle Book.

Frederick Swan, New York city.—This is a book-like case, the covers of which are covered inside with cloth suitable for sticking the needles, and padded. The cloth is divided into sections for the different sizes and styles of needles, and numbered accordingly, with a partition to prevent the needles of one side from interlocking with those of the other.

Improved Sectional Bucket Pump.

George W. Burr, East Line, N. Y.—This consists of a bucket made in sections, which are so constructed that they pack tightly together when the bucket is raised, and loosen or contract when it is lowered, the same being connected with the plunger rod by means of a cup.

Improved Egg Beater.

Martin Cline, Chicago, Ill., assignor to himself and William J. Cline, same place.—To the cylinder and piston, ordinarily used with a perforated bottom for egg beating, the inventor adds a downwardly-tapering nozzle, downwardly-decreasing reticulated diaphragms, and a rest having bottom notches. By this improved construction, the accidental dislocation of the diaphragms is prevented, and the beater held firmly against the bottom of the dish into which the eggs are broken, while egg substance is more gradually drawn up and less crowded in its passage upward.

Improved Clothes Pin.

Otis F. Porter, Bridgeport, Conn.—This clothes pin is of two parallel strips, having a bevel at each end, an intermediate elastic block, and an embracing wire around strips and block. The wire and block have sufficient elasticity to allow the strips to separate and then clamp the clothes line.

Business and Personal.

The Charge for Insertion under this head is \$1 a Line.

Sewing Machine Needles—12 for 50c., any sizes, any machine, best quality. Geo. P. Bent, Chicago, Ill.
Agricultural Implements, Farm Machinery, Seeds, Fertilizers. R. H. Allen & Co., 199 & 191 Water St., N. Y.
Magic Lanterns, Stereoscopes of all sizes and prices, for Parlor Entertainment and Public Exhibitions. Pays well on small investment. Catalogues free. McAlister, Man'g. Optician, 49 Nassau St., N. Y.

Models for Inventors.—H. B. Morris, Ithaca, N. Y.
A Situation Wanted by an Engineer of Stationary Engine. Address H. Williams, East Arlington, Vt.

Wanted—Priced Catalogues of Iron Fountains, Statues, &c. E. L. Ransome, 10 Bush St., San Francisco.

The Philadelphia "Sunday School Times" says of Geo. P. Rowell & Co., of New York: "They are the most enterprising, prompt, systematic and reliable Advertising Agents with whom we are acquainted. We have had some most satisfactory dealings with them in some extensive advertising plans in our business."

Wanted—Foreman to take charge of Machine Shop; must be well posted in modern Saw Mill Machinery and Steam Engines. Permanent situation and good salary. References required. Smith Elkins Manufacturing Company, Sherbrooke, Prov. of Que., Canada.

For Sale—The entire Patent or State Rights for the best Boiler Flue Cleaner in use. Address Jacob Armbruster, Petroleum Center, Pa.

Best Silk and Cotton Magnet Wires. Frank S. Mead & Co., Providence, R. I.

M'f's of small, profitable, saleable, patented goods, needing pecuniary assistance and a driving general agent, please address E. E. Roberts, 119 Liberty St., N. Y.

Wanted to hire, for six months, with privilege of purchase, a small Iron Planer, 4 or 5 ft. bed. Henry Whitney, Box 97, Rahway, N. J.

Gilman Sample Vial, with Scales, \$12; without, \$10 per Gross. Agents wanted. R. d'Heureuse, P. O. Box 395, New York.

Mechanics, send immediately for a set of tables you cannot do without. Price 25 cents. E. B. Knight, Manayunk, Philadelphia Co., Pa.

Wanted—Foreman in an Agricultural Machine Shop. Reference required. Address Harris Manufacturing Company, Janesville, Wis.

English Sparrows Wanted. Send prices to H. C. Draper, Oswego, Kan.

For the Original Skinner Portable Engine (improved), 2 to 8 H.P., address L. G. Skinner, Erie, Pa., late Skinner & Walrath, Chittenango, N. Y.

Stamps for Live Young Men—The American Burglar Proof Key Fastener. Send 25c. for Sample. C. E. Dayton & Co., Meriden, Conn.

A 2 Horse Steam Engine and Boiler, in complete running order, for sale cheap. W. Campbell, 87 Center Street, New York.

Every Metal Worker should have a Universal Hand Planer. Address J. E. Sutterlin, 60 Duane St., New York.

Saw Ye the Saw?—\$1,000 Gold for Sawmill to do same work with no more power Expended. A. B. Cohn, 197 Water St., New York.

A Rich Gold Mine Discovered for Agents Selling very desirable new Patent Articles for housekeepers and others. G. J. Capewell, Cheshire, Conn.

English Agency.—A gentleman, with best connections in England and highest references here, would undertake to represent a company or firm manufacturing goods suitable for the British markets. Those willing to offer liberal inducements may address Agency, care "Scientific American," 57 Park Row, New York.

For Sale—A new patent for a Cross-Cutting Machine, the best in the market. Can be seen in operation 124 Goerck St., New York. Inquire for Geo. Marshall.

For Sale—A lucrative patent on Christmas Tree Candle Holders. Address Wm. Ulrich, 49 Montgomery Street, Newark, N. J.

Soap Stone Packing in large or small quantities. Walrus Leather Wheels for polishing any Metals. Belt Studs for fastening Leather or Rubber Belts. Baxter Wrenches for difficult corners. Greene, Tweed & Co., 18 Park Place, New York.

Three Second Hand Norris Locomotives, 16 tons each; 4 ft. 8 1/2 inches gauge, for sale by N. O. & C. R. R. Co., New Orleans, La.

For Sale—Factory. Two Stories, 36x80—Engine and Boiler, 40 horse power—Shafting, Steam Dry House, Sheds, etc. Lot, 340x220 ft.. Good chance for manufacture of cheap furniture or agricultural implements. Hardwood lumber in abundance and cheap. Address, for particulars, Sawyer & Co., Meadville, Pa.

Agents.—100 men wanted; \$10 daily, or salary, selling our new goods. Novelty Co., 300 Broadway, N. Y.

Thomas's Fluid Tannate of Soda never fails to remove Scale from any Steam boiler; it removes the scale-producing material from all kinds of water; cannot injure boiler, as it has no effect on iron; saves 30 times its cost both in Fuel and repairs of Boiler; increases steaming capacity of Boiler; has been tested in hundreds of Boilers; has removed Bushels of Scales in single cases. It is in Barrels 500 lb., 1/4 Bbls. 250 lb., 1/2 Bbls. 125 lb. Price 10 cents per lb., less than 1/4 price of other preparations, and superior to all others. Address orders to N. Spencer Thomas, Elmira, N. Y.

For Tri-nitroglycerin, Mica Blasting Powder, Electric Batteries, Electric Fuses, Explosives, Gutta Percha Insulated Leading Wires, etc., etc., result of seven years' experience at Hoosac Tunnel, address Geo. M. Mowbray, North Adams, Mass.

For Sale—Valuable Manufacturing Property; commodious buildings; driving-power, shafting, belting, etc; good order. Great sacrifice. For description, address "The Cosmos," St. Charles, Mo.

Faught's Patent Round Braided Belting—The Best thing out—Manufactured only by C. W. Army, 301 & 303 Cherry St., Philadelphia, Pa. Send for Circular.

Price only \$1.50.—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.

Zero-Refrigerator with Water Cooler. Best in the World. Send for Catalogue. A. M. Lesley, 221 W. 25th Street, New York.

The Lester Oil Co., 158 Water St., N. Y., Exclusive Manufacturers of the renowned Synval Lubricating Oil. The most perfect and economical lubricant in existence. Send for Circular.

Wash Stands, New Styles, Marble Tops, can be used in any situation. Prices very low. Send for catalogue. Bailey, Farrell & Co., Pittsburgh, Pa.

Send for Circular of a very Superior Boiler Feed Pump. D. Frisbie & Co., New Haven, Conn.

The Baxter Steam Engine, 2 to 15 Horse Power. Simple, Safe, Durable, and Economical. "The Best are always the Cheapest." Over One Thousand in use, giving entire satisfaction. Address Wm. D. Russell, 18 Park Place, New York.

Engines, 2 to 8 H.P. N. Twiss, New Haven, Ct.

Diamond Carbon, of all sizes and shapes, for drilling rock, sawing stone, and turning emery wheels, also Glaziers' Diamonds. J. Dickinson, 64 Nassau St., N. Y.

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

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

Spinning Rings of a Superior Quality—Whitinsville Spinning Ring Co., Whitinsville, Mass.

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

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.

Small Tools and Gear Wheels for Models. List free. Goodnow & Wightman, 23 Cornhill, Boston, Mass.

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

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

Temples and Oilcans. Draper, Hopedale, Mass.

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

Mechanical Expert in Patent Cases. T. D. Stetson, 23 Murray St., New York.

All Fruit-can Tools, Ferracuts, Bridgeton, N. J.

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

Notes & Queries

T. C. W. should consult a physician.—G. S. W. will find a recipe for paste that will not sour on p. 219, vol. 30.—L. S. will find a recipe for French polish on p. 11, vol. 32.—H. H. can tin cast iron by the process described on p. 382, vol. 31.—H. V. will find full directions for tempering steel in the early chapters of "Practical Mechanism," and for constructing a small furnace on p. 235, vol. 32.—G. W. P. will find directions for making a battery for plating on p. 202, vol. 32. A good alloy for castings is described on p. 104, vol. 24.—W. M. will find a description of water filter on p. 251, vol. 31.—J. D. will find directions for hardening tallow on p. 201, vol. 24.

(1) J. E. J. says: 1. Please explain the following: "A round hole, the size of the lens, was made in each, the meniscus being contracted to 3/4 inch, and the eye glass to 1/4 inch diameter." A. If a lens is bad, the edge zones are cut off by a stop or diaphragm. 2. What would be the power of a telescope made as directed, with a meniscus object glass of 1 inch diameter and 48 inches focus, with an eyepiece (plano-convex) of 1 inch focus? A. Forty-eight. 3. Which would be better, the above, or an achromatic object glass of 2 inches diameter and 30 inches focus, with a plano-convex eyepiece of 1 inch focus? A. The achromatic.

(2) J. E. J. asks: What will be the power of a telescope with an achromatic object glass of 2 inches diameter and 30 inches focus, and a plano-convex eyepiece of 1 inch diameter and 2 inches focus? I wish to make the best telescope of which the cost shall not exceed \$10. The above lenses will cost \$5 or \$6; are they as good as I can expect for the money? A. Yes. Power, 18. See previous answers for construction of eyepieces.

(3) W. A. asks: At what distance will the most powerful telescopes observe any moving object? A. Under the most favorable circumstances, about 190 times as far as it can be seen without the aid of an instrument.

(4) W. S. H. says: I wish to make a telescope of sufficient power to view objects 1 or 2 miles off. Will the following glasses do? Object glass of 3 inches diameter, 20 inches focus, achromatic; 3 double convex lenses, 1 inch in diameter, set 1 1/4 inches apart, constituting the eyepiece. A. This is a bad form of telescope. The objective is of too short focus for the aperture, and the erecting eyepiece performs better with 4 lenses than with 3. See No. 48, September 26, 1874, and consult our optical answers for a year or two back.

(5) T. & Co. ask: We have a large lens, diameter 3 1/4 inches. It is scratched, and needs repolishing. How can we do it? A. The scratches on your camera lenses will very slightly lengthen the necessary exposure. It would not pay to repolish them.

(6) R. H. S. says: 1. Please say what particular advantages there are in periscopic spectacles over plano-convex for near-sightedness? A. The periscopic give a larger field of view. 2. What is polarized light? A. Light waves split in two so that one ray vibrates in one plane and the other in a plane at right angles thereto. This is effected by a bundle of thin glass plates or by a Nicol's prism. 3. Is there any other method to produce the achromatic effect in lenses than by combining flint and plate glass lenses? A. The outstanding aberrations of a combination such as a microscopic objective are corrected by the opposite aberrations of the back lens and of the eyepiece. 4. What is a good work on optics? A. Stillman's "Physica," though not very recent, contains the best optical formulae for achromatism. Atkinson's "Ganot" is atrociously deficient in this respect.

(7) A. S. asks: If a cistern is 11 feet in diameter and 9 feet deep, how many gallons will be its contents? A. Multiply the square of the diameter by 5.875 times the height, to find the contents in U. S. gallons.

(8) J. B. C. says: I have, for this last 25 years, on every Saturday evening turned the in-

nerside of my engine belt outside, let the engine run slow, and washed the belt well with warm water and soda, applied with cotton waste. Next, I take a piece of sheet metal and scrape well the belt, next wash with clean warm water, and dry off. I collect the waste oil from the shafting, and apply to the belt as much of it as possible. The washing must be done as quickly as possible so as not to dissolve the glued parts. I let the belt stand on the pulleys till Monday, then give another scraping and turn the belt as before. I keep the pulleys very clean. I have long been surprised at the economy I have effected, with very little trouble. I have not bought a new belt for the last ten years. There is an engine next me, 14x36 inches (mine is 12x36). I have nearly double the shafting and belts, and my neighbor cannot run with less than 35 lbs. of steam when all the belts are on the loose pulleys. Mine will run at full speed with 5 lbs. A. These suggestions will be appreciated by our readers. One must begin with a first class belt, made in the best manner, and use considerable judgment, in following the practice of our correspondent.

(9) D. L. C. asks: What causes the diurnal motion of the earth? A. The vortical movement of nebulae, cyclones, and eddies is produced by streams of particles meeting from nearly opposite directions.

(10) F. W. M. asks: 1. Is 1/4 lap on the slide valve 3/4 on one end, or is it 3/4 on one and 1/4 at the other? A. On one end, 2. What is meant by the longitudinal and curvilinear seams of steam boilers? A. Longitudinal, in the direction of the length; curvilinear, around the shell. 3. Does the crank of a steam engine move six times as far while the piston is making the first inch of the stroke, as it does while it is making the middle inch, and a little over twice as far while it is making the second inch, and a trifle over 1 1/2 times while it is making the third inch? If so, does the same variation apply to all engines regardless of length of crank? Is there any rule by which to find the distance the piston moves while the crank is describing a certain part of the circle? A. It depends upon the relative length of connecting rod and crank. You will find a table giving the desired information on p. 164, vol. 32. See also Auchincloss' treatise on "Link and Valve Motions."

(11) C. W. S. says: You state that the difference between high and low pressure is that in one the steam is condensed, in the other it is exhausted into the atmosphere. A. Claims that the one in which the steam is condensed is the high pressure. Is he right? A. No.

How far can sound be heard and words be understood through speaking tubes? A. Several hundred feet, so far as our experience goes.

(12) L. R. B. asks: 1. What power, as usually rated on steam engines, is required to drive a 17 inch surface planer on thin soft wood? A. From 5 to 6 horse. 2. What is needed to drive a 15 inch circular saw in 6 inches of soft wood? A. From 12 to 15. It is to be observed that these estimates are for driving the machines up to their capacity, so that the power required can be reduced considerably if less work is done by the machines. 3. What is commonly used to thin printer's ink? A. Soap is very often employed.

(13) T. McK. says: I have a small camera obscura with a double convex lens, and I find that it does not give a distinct picture of objects at unequal distances from the camera at the same time. For example, when an object 12 feet distant is distinctly shown, another 16 or 18 feet distant is indistinct, and vice versa. 1. What combination of lenses is necessary to produce a distinct picture of both objects at the same time? A. You should focus on the foreground, and put a cardboard stop a couple of inches in front of lens, diminishing its aperture. 2. What combination of lenses is used in photographing landscapes? Is there any difference between a landscape and portrait combination, and if so, what is it? A. See answer No. 59, February 27, 1874.

(14) J. C. says: I have a cranberry patch of 2 acres. It is flooded with water early in November annually. The dam is made of swamp dirt, and (at the outlet) is 7 feet in width by 6 high. The water is 3 feet in depth at the place of drainage. For the past two seasons a box made of plank without bottom has been made for the water to pass through in summer, and this box closed with dirt in winter, and made in the most thorough manner; but the frost elevates the plank and the water breaks away underneath, and the vines are drained of water. The question is, is there any method of inserting anything, that it may hold water? A. It is difficult to prevent such action in very cold weather.

(15) E. E. W. asks: 1. How can I, having a lens of 16 7/8 inches radius on one side, calculate the radius for the other side, to make a lens of any required focal length? A. To find the principal focus of double convex lenses whose refractive index is 1.5: Divide twice the product of the radii by their sum. Quotient=focus for parallel rays. 2. How can I make it a double convex of 11.5 inches focal length? A. Second surface, 9 inches radius of curvature.

(16) J. S. asks: What width of flat belt will convey the same power as a 3/4 round belt running in properly grooved pulleys? A. About 2 inches.

What will be the centrifugal force in lbs. of ten iron balls weighing 1 lb. each attached to a wheel two feet in diameter and running at a velocity of 3,000 revolutions per minute? A. The centrifugal force in lbs. is found by multiplying the weight of the body in pounds by the square of the number of revolutions per minute, and by the radius of the wheel in feet, and dividing the product by 2,665.

(17) D. W. asks: What is meant by horse power of engines? A. Horse power is a technical term for a unit of work, in a minute, equivalent to 33,000 foot pounds in that time.

(18) M. R. asks: Does a crank pin turn on its axis when an engine is at work? A. No.

How is beeswax bleached? A. There are several processes: exposure to the air, treatment with chemicals, treatment with steam. See p. 229, vol. 30. How can I tan sheep skins when they are very dry and old? A. See p. 233, vol. 26.

(19) F. G. P. says: You said in a late issue that the cylinders of the Great Eastern were 14 feet long. Will you please tell me if they were oscillating? A. Yes.

(20) G. S. C. says: If C. B. F. will take the precaution to moisten the contents of the porous cups with the ammoniac solution while packing the carbons, he will be able to obtain a current as soon as the circuit is closed. I have two similar cells in which the peroxide of manganese used was in a fine powder, and the coke was likewise in powder, but a little coarser.

(21) W. E. H. asks: What work on electricity is the best in all its details? A. De la Rive's works are probably the most comprehensive upon the subject.

(22) T. M. Jr., F. P. L., J. A. T., and others.—The phenomenon you observed was unusually beautiful. Parhelia and bands of light passing through the sun are attributed to reflection from ice prisms which float, up to an inch in diameter, in summer air currents, above 1/2 mile high. Any change in the temperature and density of the air alters the path of the rays and inverts or distorts images like a speculum polished while unequally warm.

(23) W. A. S. asks: How shall I wash nickel, precipitated in nitric acid, by adding cyanide of potassium? A. In water. 2. How shall I insulate a copper wire above the junction with the copper plate in the bottom of a Callaud battery cell? A. With gutta percha. 3. What materials are used in making silver and gold solutions for plating with? A. See No. 26, p. 218, vol. 32.

COMMUNICATIONS RECEIVED.

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

On Kaolin. By J. T. A. H., by W. C. K., and by N. W. B.

On the Number Seven. By J. D. L.

On a Boiler Explosion. By H. W. G.

Also enquiries and answers from the following.

W. H.—S. C. H.—A. J. K.—L. M. W.—F. N.—J. T. O.—F. P. 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 enquiries analogous to the following are sent: "Who makes hydraulic motors for sewing machines? Who makes springs for propelling street cars? Who sells the best emery for grinding glass? Who sells artificial stone? Who sells iron work for aquariums? Who sells mangles? Who publishes a paper printed in phonography?" 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.]

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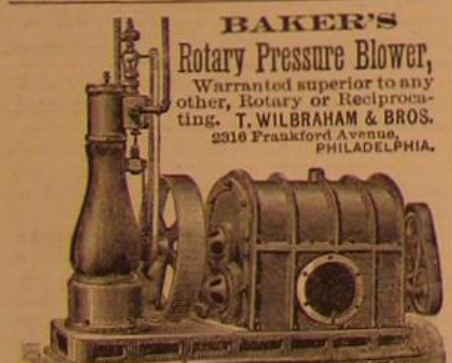
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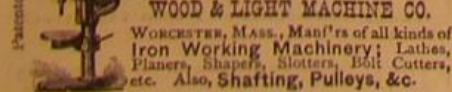
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SCIENTIFIC AMERICAN

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

Vol. XXXII.—No. 18.
(NEW SERIES.)

NEW YORK, MAY 1, 1875.

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IMPROVED SHINGLE AND HEADING MACHINERY.

We illustrate herewith three improved machines for shingle manufacture, which, though they have been before the public for several years, have, during the period since their introduction, been made the subject of numerous improvements, so that, at the present time, they are now offered in highly perfected form.

Fig. 1 represents Everts' patent twelve block rotary shingle machine. Upon each of two sides of a frame, about seven feet square, is placed an upright shaft. These shafts each carry a horizontal saw, and above the saws a circular carriage, some eight feet in diameter, is mounted. The carriage is divided into twelve spaces, into each of which a block, to be cut into shingles, is placed while the carriage is in motion, new blocks being supplied as fast as the first ones are cut up by the saws. It is stated that twenty thousand shingles per hour can thus be made. The carriage is driven by two friction rollers, which cause a uniform and steady feed, and prevent back lash. The motion is positive and continuous, there being no springs or other gear to get out of order. The dogs are simply weights raised by an inclined plane to drop off the end and fasten the block while the saw is passing through.

But one man is required to place the bolts within the revolving carriage, while a boy can easily remove the slabs from the opposite side. This is done without delay or danger, as the bolts are free except when the saw is passing through them. The work produced is smooth; and as the tables are stationary and not tilted to produce taper when the apparatus is once adjusted, the shingles produced subsequently are exactly alike.

The machine is claimed to saw at least double the shingles of an ordinary two-block machine, and quadruple the shingles of any hand-fed one-block apparatus. If only half the capacity of the machine is required, or a production of from 65,000 to 75,000 shingles per day, but one saw need be used.

The apparatus is made to saw shingles from 16 to 18 inches in length, and is further claimed to saw up closer

and make fewer clip shingles than any other device of like nature.

The Everts hand-feed one-block machine, which is represented in the second engraving, has one saw shaft, and a reciprocating carriage operated by hand. Eccentrically geared automatic feed works are added, so that the feed may be either automatic or by hand, as the user may desire. Perfectly tapered shingles, of any required thickness at top or

pine or cypress timber, and from 8,000 to 12,000 pieces of heading.

The third figure represents Low's patent shingle and barrel head sawing machine, a light running and portable apparatus, easily attached to any kind of power, and excellently suited for shingle and flour barrel head work. The saw is arranged in a vertical position, so that the bolt gate or carriage moves in a similar direction. The gate is counterbalanced and has a head block to hold the bolt, which is fed out over the saw, and then depressed while the latter cuts off a shingle. The bolt then rises, and a similar movement of the feed pushes it outward in place for another cut. The saw does not have to be removed from the machine to be gummed or filed, and it does its work with the grain of the timber, requiring no countershaft to run it. The dogs are set but once for each block. The capacity of the machine is from 20,000 to 30,000 shingles per day.

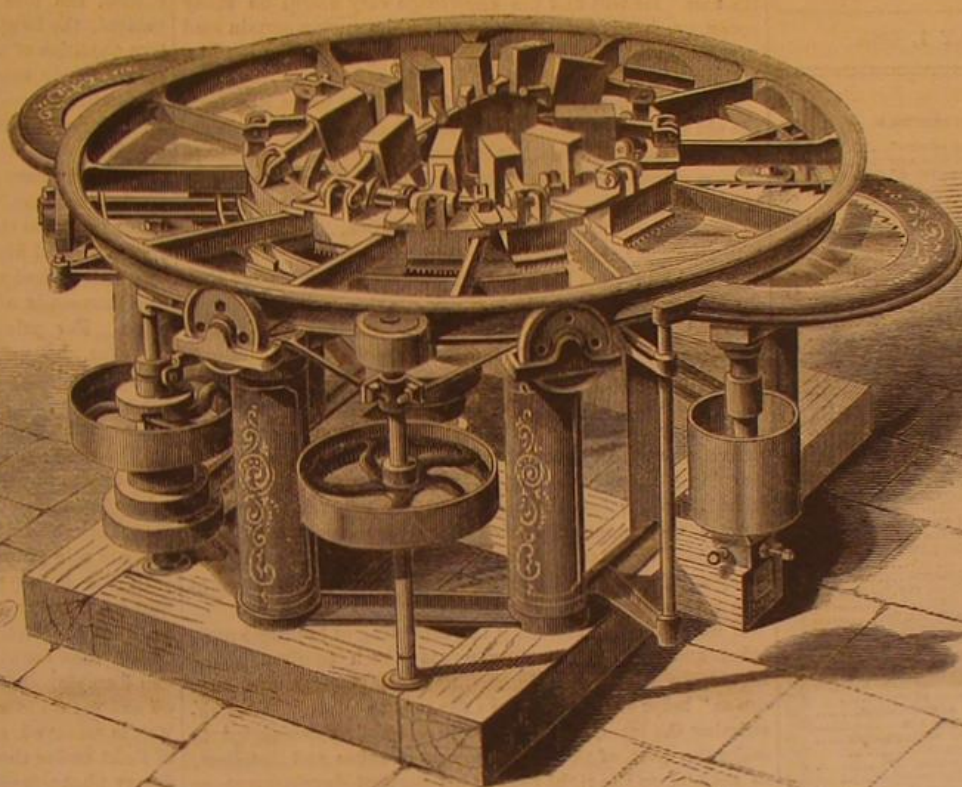
In addition to the foregoing, the manufacturers, Messrs. C. S. & S. Burt, of Dunleith, Ill., produce every kind of machine necessary for a complete outfit for making shingles and heading, including dog saws, saw bolting apparatus, knife or wheel jointers (double or single), knot or saw jointers with one or two saws, different styles of bunching machines, etc.

For further particulars regarding these various devices, address the Messrs. Burt, as above.

Venus.

The Italian observers at Mad-dapore, in Bengal, to which party the eminent spectroscopist Tacchini belonged, besides observing all four contacts, ascertained an important fact respecting the atmosphere of Venus. The ring around the planet, which in the former transits, as in the present one, was visible around Venus both on and off the sun, indicates in the spectroscope that the atmosphere contains aqueous vapor.—*Nature*.

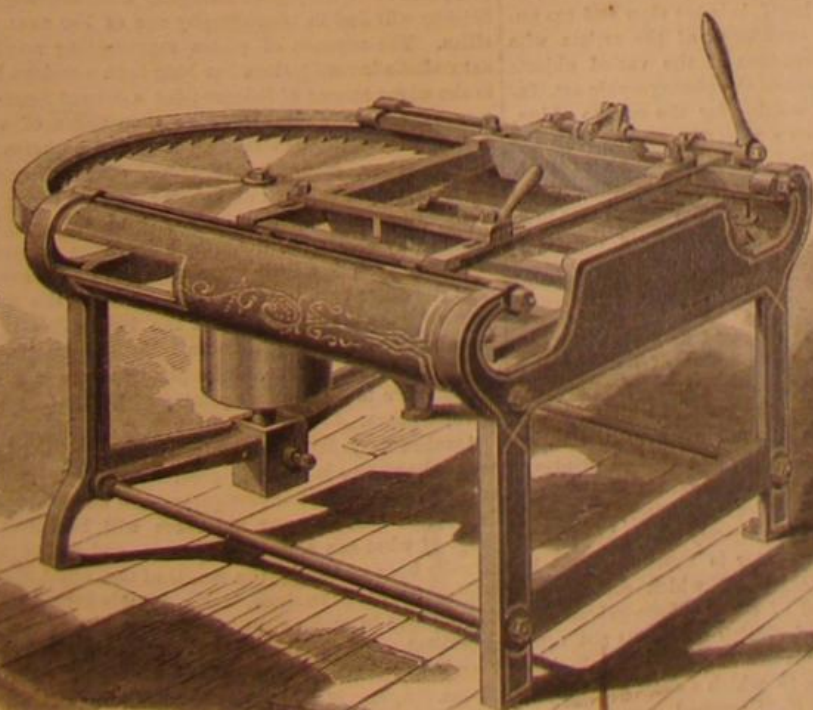
WHEN the stoves are taken down, see that the pipe openings in the wall are protected by good tin covers. Don't stuff rags in



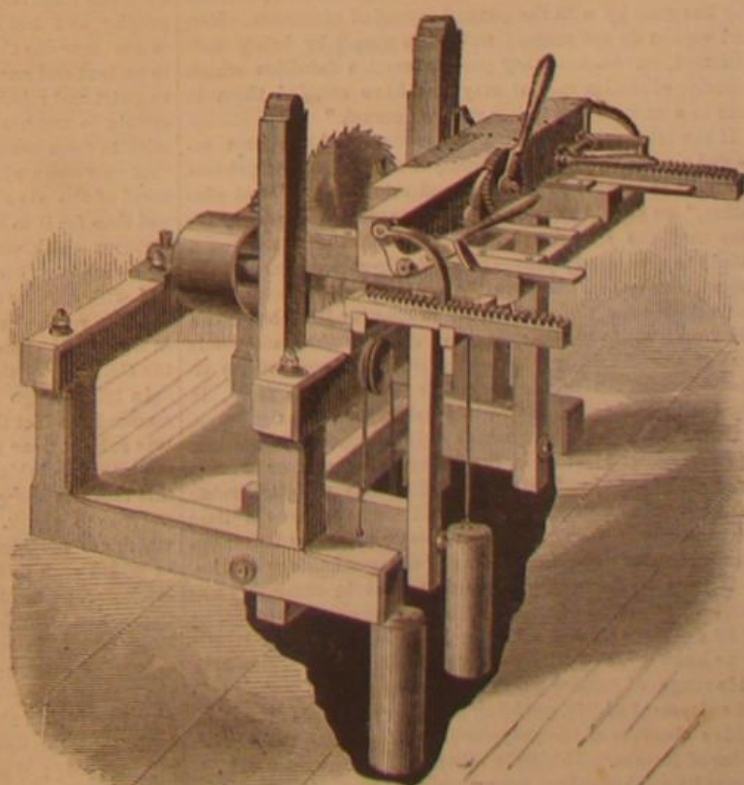
EVARTS' ROTARY SHINGLE MACHINE.

butt, can be made from 16 to 24 inches in length and up to 15 inches in width. No extra fixtures are required for sawing oak and other heading, it being possible, by suitable arrangements, to saw oak thick at the top and thin at the heart.

The machine is made with saws from 36 to 48 inches. The 36 to 40 inch saws are used principally for shingles, and the larger sizes for sawing heading, fruit box stuff, and other boards, up to 30 inches in length. The capacity of the apparatus is from 25,000 to 30,000 shingles per day in good



EVARTS' HAND FEED SHINGLE MACHINE



LOW'S SHINGLE AND BARREL HEAD SAWING MACHINE

Scientific American.

MUNN & CO., Editors and Proprietors.

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VOLUME XXXII, No 18. [NEW SERIES.] Thirtieth Year.

NEW YORK, SATURDAY, MAY 1, 1875.

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THE MONEY VALUE OF EDUCATION.

Says an English writer, whose remarks have been widely quoted in this country: "There was a time when what is generally understood as a good education had a pecuniary value of some importance both to men and women; but its day has gone by with the general spread of education. Men and women do not succeed nowadays simply by being well educated, but because they possess certain faculties which superior education may or may not have enabled them to turn to a more or less remunerative account."

If the favor with which these assertions have been received among us betokened merely a widespread scepticism in regard to what is "generally understood to be a good education," we should have no objection to make. It is only too true that the traditional culture, which the schools aim chiefly to give, rarely proves of much direct pecuniary value, even where it does not have the contrary effect of unfitting the recipient for the conflicts of productive life; but it is a grievous error to suppose, as many do, that the same holds true of what is really good education: an error that has already done much mischief, and is likely to do more, in leading the rising generation to despise instruction.

So far from having its money value lessened, education, properly so-called—that is, the fitting of the man or woman to meet the demands of modern life—has a higher value than education ever had before. There never was a time when proper culture gave a man greater power or better opportunities for gathering to himself the good things of life. It is quite another thing to say that what is commonly understood as a good education fails to prove so advantageous to its possessors. Not all knowledge is power; nor is the same knowledge equally powerful at all times. There is a wide range of culture which merely fits a man for the highest enjoyment of life, enabling him simply to be an appreciative observer of the progress of humanity and the vicissitudes of Nature. This adds value to life, but does not increase its market value; accordingly we leave it out of this account. There is again a wide range of knowledge which

simply puts a man on a level with his neighbors, and therefore conveys no relative advantage, though the lack of it might prove a serious disadvantage: a range of knowledge which necessarily widens with the general spreading of education.

For instance, among illiterate people, the man who has penetrated the mystery of letters may gain thereby a signal superiority, as in medieval Europe. The exercise of the arts of reading and writing under such circumstances brings him money: at least they may secure to him the "benefit of the clergy" in case of necessity, not, as often supposed, the unsubstantial benefit of being prayed over when condemned to death, but complete exemption from civil trial and conviction. With us, where nearly everybody reads and writes, these arts are relatively of lower value.

A few years ago a tolerable knowledge of arithmetic, with a good handwriting and some acquaintance with the art of keeping accounts, was a certain passport to profitable employment. The useful art of bookkeeping was then a mystery to the multitude, and therefore had a considerable money value in the markets. To-day, when nine boys out of every ten are more or less familiar with these elements of a business education, and too large a proportion vastly overestimate the importance of them and expect to thrive by them alone, such knowledge gives a young man no special distinction. He will find the knowledge very useful on many occasions; but it will rarely prove to him such a certain road to fortune and fame as the business colleges would have him believe.

In like manner, the trumpery information to be had from the old style school books once had a certain money value. However useless in itself, it at least enabled the possessor to "keep school" and flatter himself that he belonged to a learned profession. Now that such knowledge is as common as common schools, its special value is gone.

Shall we say, from facts like these, that the money value of a good education is declining? Not at all; but merely that the elements of a practical money-making education have changed. Given these elements, with sufficient force to use them, and there is no end to their money value.

Of course this does not imply that the scholar of little force will always be able to compete successfully with the untaught or, more properly, self-taught man of superior native talent. An ounce of mother wit is worth a tun of learning without wit to-day as it was when the proverb was coined. Nevertheless the man (whether naturally weak or strong) with proper education is sure to surpass a man of corresponding force without such education, other conditions being equal. Everything hinges, however, on what we regard as a good and proper education.

If we dignify by that term the veneering of hearsay knowledge and useless accomplishments which so often passes for culture, then it is right enough to say that "a good education" helps one very little in the battle of life. But restricting the term, as we ought, to a training calculated to make the most of the child's powers of sense and intellect, to set him on the right road to his highest development as a thinker and doer, while making him actively acquainted with the best results of human effort, especially in the department to which his life work is to be directed—then, we say, the money value of a good education is immensely greater than ever before.

To circulate unqualified condemnations of education is about the worst thing our newspapers can do. Perhaps the best is to insist continuously on a closer adaptation of school work to the needs of the times, and the encouragement of out of school work fitted to make our youth apt and skillful and intelligent as productive workers.

PHOTO-MECHANICAL PRINTING.

There is perhaps no more inviting and fruitful field for scientific discovery and invention than in the line of photography, and but little attention to the subject is required to convince one that this field is fast yielding up its treasures to patient and successful investigation. Though the sun is as swift and reliable as time itself, it is too slow and too uncertain to command the full confidence of the artists who wish to form permanent impressions of the varied objects that now come within the scope of the photographic art. Instead of the slow method of waiting for the sun to shine, and then for it to transfer from a negative, one by one, the pictures which will continually fade by the action of light, this work can now be done by the ordinary printing press and with durable carbon printer's ink. Yet the results thus speedily reached are not like the cheap woodcuts that issue in almost fabulous numbers from the press, but have more the character of the finely cut lithographic pictures.

In 1839 Mungo Ponton, a chemist of Bristol, Eng., announced the fact that sized paper, treated with a bichromate, was subject to an alteration, by the action of light, which rendered insoluble the sizing which the paper contained. In this fact lies the germ of all the processes of which it is our purpose to speak. The following are some of the many which are modifications of this principle: Carbon printing, in which each picture is itself a sheet of gelatin of required thickness, permeated with the coloring matter, and each impression is made by the direct agency of light; photolithography, in which the transfer is made on stone by means of gelatin; photo-zincography, which differs from the last by using zinc instead of stone; photo-galvanography, in which a sheet of gelatin—with the parts not acted on by light swollen by water—is made to serve as a basis of electrolytizing; Woodburytype, in which a sheet of gelatin—with the parts unacted on by light washed away—is used as a means of obtaining, by hydraulic pressure, a metal mold.

This mold is filled for every impression with gelatin containing coloring matter, and the print is really an embossing, so to speak, of colored gelatin on the paper. From the impression on the metal—which is an alloy of zinc and antimony—these types are printed on prepared paper, by a small hand press resembling the printing press.

In 1855 M. Poitevin, a French engineer, discovered that bichromatized gelatin, acted on by light, had the properties of a lithographic stone, and might be used as such. Since the parts on which the light has acted are impervious to water, upon moistening the plate some of it will be dry, some wet; and where light partially acted, it will be part dry and part wet. Now, as oil and water repel each other, by putting grease upon this plate, it will adhere entirely to the dry parts—those which were exposed to light,—partially to those under partial light, and not at all where it took up moisture. And now, by rolling over this plate a cylinder of lithographer's ink, the plate is ready to make a lithographic print. This idea, with modifications in its mode of application, has its representatives in various processes now employed. Among these we will briefly notice only two.

Mr. Joseph Albert, court photographer of Munich, has shown great ingenuity in perfecting what is now called the Albertype process. He commenced in 1868; and after numerous experiments for fixing, to the plate on which it is spread, the film of gelatin from which the pictures are printed, the happy thought occurred to him to use the sensitive qualities of the chromic gelatin itself for a cement. He consequently used a plate of glass, spread upon it a coating of gelatin, then—while the front surface was protected by an underlayer—exposed the back or glass surface to light, which rendered it insoluble; and hence adhesive to the plate in presence of water. He hardened the sensitive surface by chrome alum, chlorine water, and other coagulating solutions; and to make it as tough and hard as possible, he spread several films one upon another, hardening each in its turn till he had made a sensitive plate so hard and durable that thousands of impressions could be printed from one plate. For printing the impression transferred under a negative, he uses a lithographic press and the ink commonly made to accompany it. After this, no washing, toning, etc., is necessary, but the picture is complete when it leaves the press. Any kind of paper and any colored ink may be used; titles, descriptions, dates, etc., can be printed at the same impression; and one negative can be stereotyped *ad infinitum*. The Photo-Plate Printing Company, of New York, and the Albertype Printing Company, of Boston, are sole proprietors of this patent.

In the heliotype process, some perfectly flat surface is first coated over with wax; upon this is then poured a hot solution of gelatin, after which bichromate of potassa is added, then burnt alum or tannin, to make the surface fine and durable. After it has hardened, the sheet is stripped off and set up in an achromatic chamber to dry. Then the wax is removed, and the sheets are ready for the reception of light under the ordinary photographic negative in the ordinary photograph printing frame. The sheet of gelatin is then forced by pressure under water upon a flat plate of metal; and when the water has been pressed out, it is ready for printing in any ordinary printing press. Several thicknesses of ink are used, and for the deepest shades a little oil is added, which will adhere only to the deeper shadows. The plate must be kept moist in printing; and if moistened with colored water or Indian ink, a picture resembling a Rembrandt or Indian ink picture can be obtained.

These two processes, with that of the Woodburytype briefly mentioned above, have lately been used with great profit and satisfaction by Mr. Alex. Agassiz and others, for representing natural history specimens, in the Illustrated Catalogues of the Museum of Comparative Zoology, Zoological Results of the Hassler Expedition, etc. The negatives of these plates were all taken by Mr. A. Lowell, as they are ordinarily made for silver prints. By each of these processes very satisfactory results were secured, as well in regard to expense and correctness of plates as in their general execution. And the prospect is cheerily encouraging that ere long Natural Science will find in photography one of her most profitable allies. The expense of plates representing results of the naturalist's investigations has long been a serious hindrance to the advancement of Science; for a correct figure is often more expressive and instructive than pages of verbal description. By these methods, the cost of a quarto plate, including paper, mounting, lettering, etc., and exclusive of the negative, is only ten or fifteen cents per copy; and this is hardly more than the mere cost of lithographic press work, to say nothing of the artist's drawings on stone. The Woodburytype is a little more expensive and cumbersome than the other two, because, on account of the method of preparing the plate from which the impression is taken, it must be mounted for protection. Notwithstanding this, it will not preclude its use, for its pictures have a remarkable resemblance to good silver prints, with all their brilliancy and sharpness.

Another very important advantage those methods have over lithography is in their greater accuracy. By them the original sketches of investigators can doubtless be reproduced, and "subsequent observers will be better able to judge of what has actually been seen, and not of what has actually been added by the pencil of the artist who copies original drawings on stone." Mr. Agassiz finds it less trouble and expense to employ the carbon processes, even when it necessitates occasional visits to New York and Philadelphia, than to superintend, in the Museum itself, the lithographic plates. Again, Mr. Agassiz says: "On account of time required to complete a large number of plates, either as engravings or lithographs, it would be utterly impossible to

issue so great a number of plates within the period required for permanent photographs." From a lithographic plate only about 500 good impressions can be taken, but here they can be made by thousands. It will also be of great advantage in copying plates from monographs, or valuable pictures of any kind which are out of print or otherwise inaccessible.

IMPROVEMENTS AT THE MOUTH OF THE MISSISSIPPI.

The long discussion relative to the most practicable method of improving the mouth of the Mississippi, so as to render the same passable to vessels of deep draft and thus to open the river ports to direct ocean traffic, was virtually terminated by the granting of an appropriation by the last Congress, for the construction of a system of jetties at one of the passes through which the stream enters the Gulf. The plans involving canals, which have been strenuously advocated by many eminent engineers, are therefore for the time at least set aside, and to Captain J. L. Eads, an engineer now widely celebrated for his successful construction of the St. Louis bridge, has been entrusted the task of causing the mighty current of the Father of Waters literally to undo its own work and to break down the barrier which itself has created.

The Delta of the Mississippi is formed of narrow strips of land, mostly low lying banks, through which the river winds until it makes its exit to the Gulf by a number of narrow passes. In some of these channels, previous attempts have been made to deepen them by dredging, with but partial success, however, as a single flood has been known to carry down sufficient sediment to fill them to their original depth; and the current besides, emptying into the open water at the mouths, speedily left at that point bars of blue clay, surmountable only by light draft ships. The gist of Captain Eads' plan will now be readily apprehended when it is regarded as shifting the point of deposit of these barriers from the shoal water at the entrance of one pass, out into the deep water where filling up by natural causes is impossible. By this means the river current is to be made to cut out and scour its own channel across the present bar. To do this, it is obvious that the banks of the pass must be extended, so as to lead the stream far enough out; another section of conduit, as it were must, be added, and this is now to be formed of the submarine dykes or jetties.

The materials of which these structures are to be composed are willow twigs bound in bundles, termed by engineers "fascines," eight or ten feet in length and about as many inches in diameter. A large number of fascines at a time will be lashed together to form rafts, the first of which will be from seventy-five to two thousand feet in width, the largest rafts being sunk in the deepest water. The rafts will next be towed to the proper point, there loaded with stones, and submerged, and thus the work will continue, one raft being sunk above another until the surface is reached. Each line of rafts will be narrower than the one below it until the upper course will not be more than ten feet wide. The two walls which will thus be constructed will be prolongations of the banks, and between them will form a channel with sloping sides. In the course of time, the interstices of twigs and stones will fill with sand and mud, so that eventually two solid submarine levees will be produced. Very little pile work, it is said, will be required except perhaps at the head of South Pass, which is the outlet at which the jetties are to be built, in order to provide for the proper regulation of the volume of water in the new channel at various stages of the river.

Captain Eads has already begun his surveys, in which work, together with the making of the necessary contracts for materials, labor, etc., the summer will be consumed. The first raft, it is expected, will be sunk by the beginning of October next.

MOTION ON A MOVING BODY.

For the last few months we have been receiving queries from all sections of the country, something like the following: "If a train is moving at the rate of sixty miles an hour, and a cannon on the train is fired, giving the shot a velocity of sixty miles an hour, will it leave the train, or just drop down at the mouth of the gun?" We have once or twice attempted to explain the matter in our correspondence columns, but our remarks seem either to have been overlooked or misunderstood, and we must try once more to stop this stream of inquiries by satisfying the inquirers. Our remarks may also be useful in giving some of our readers more correct ideas about rest and motion than they possess at present.

The dwellers on the surface of the earth are carried through space so smoothly that many of them doubtless forget that the earth is revolving on its axis with a velocity, at the surface, of more than 1,000 miles an hour, and moving in its orbit at the enormous speed of about 68,000 miles an hour. They know, however, that they can set up a target on the surface of the earth, and pierce it with a shot that has much less than the velocity of the earth, whether the shot be fired in the direction in which the earth is moving or the contrary. It is easy to see, then, that if a ship or train is put in uniform motion, and the same experiment is tried, it will give a similar result. The reason, too, must be obvious after a moment's reflection. Everything on the ship or train being carried along with it, an additional velocity will evidently move it away from the position that it formerly occupied, to some other position on the moving body.

This disposes of the first part of the question, and now we will consider what is necessary, in order to make a body leave the ship or train. Probably some of our readers have

seen Mr. Hale's entertaining story of the "Brick Moon," which was projected into space with such velocity that it never returned to the earth. Many more of our readers, I doubt, have experienced some of the difficulties of leaving a moving body, as, for instance, a car: because, as we explained some time ago, the car had put them in motion, and so there was a liability of their being dashed back again violently if they attempted to jump directly from the rear of a train moving at high speed. Now of course the train is not going to be more considerate of the shot in a cannon than it is of a human passenger, so that, unless the powder drives it back faster than the train is moving forward, it will not leave the gun. It is scarcely necessary for us to say that the case supposed by our correspondents is a purely imaginary one, since a train or a ship does not move with perfectly uniform velocity, and neither does a shot from a cannon. Considered in this light, the subject is of no practical importance, and our only reason for referring to it in this prominent manner is to call attention to the principles involved, which are both interesting and useful. We do not propose to discuss this question of the cannon and the train any further, and beg that our readers will send us no more communications on the subject, as we have not room even for all the valuable and instructive letters that we are constantly receiving.

WHAT IS THE CAUSE OF TIDES?

There are occasional fallacies which, in some mysterious way, gain credence in the minds of men till they finally become accepted as unquestioned facts. Among these may be mentioned the oft-repeated proverb: "It is always darkest just before day," and the commonly accepted explanation of the rising of light bodies in a denser medium. It is not true that smoke, heated air, balloons, etc., rise because of their lightness, and then the air rushes in to take their place; but the air, being heavier, seeks by gravity the lowest place, and in so doing crowds up the lighter bodies. Water is said to contract down to a few degrees of the freezing point, and then to expand in changing to ice; but it is probable that the molecules are drawing closer to one another all the time, and that the apparent expansion is because the crystals of ice do not fit together exactly, and hence leave between them interstices filled with air, and thus occupy more space.

And it is quite possible, if not probable, that the common explanation of tides furnishes still another illustration. With sufficient credulity, the explained cause of the tide on the moon's side of the earth may be accepted as somewhat satisfactory; but there is room for reasonable doubt as regards that of the tide opposite the moon. This luminary is said, in the first case, to draw the water away from the earth, and in the second, to draw the earth away from the water. This is considered possible because the nearer object will be influenced more by the moon's attraction than the more distant object, and this difference of attractive force, as exerted on the stable earth and the unstable water, is said to produce the tides as we observe them. Attraction varies inversely as the square of the distance. If we represent the force with which the moon draws the earth by ten, the force with which it attracts the water on the opposite side of the earth will be about nine and two thirds. This latter force is not diminished by the intervening earth, and tends to draw the water toward the moon. The earth, by its attraction, holds the water to its surface, and its influence is not lessened when the moon acts upon it. As both these forces tend to draw the water opposite the moon toward that luminary, we would reasonably expect a low, rather than a high, tide at that point. It is said that the water remains behind by its inertia. But as the moon acts constantly upon the earth, and gradually upon any one point of its surface, the inertia of the water would be overcome at least as soon as that of the solid earth, and probably sooner, as the water is more free to yield to the influence of attraction.

Again, the theory rests on the supposition that the attraction of the moon gives the earth a daily motion toward itself; but this cannot be strictly true, for, if so, the earth and moon would be continually approaching each other, and we would live in constant fear of a collision, whereas they maintain a uniform mean distance between them. In opposition to this, it is argued that the deviations from the tangential motion of the earth in its orbit are precisely those which the earth would move through if falling toward the attracting body unaffected by any other impulse. Whether this is satisfactory, each must decide for himself.

The sun also exerts upon the earth an influence tending to produce tides, which is about two fifths as great as that exerted by the moon. The sun's real attraction, of course, is much greater than the moon's, but, on account of its greater distance, the difference between its influence on the earth and on its aqueous envelope is less. From the sun's influence, we would expect a tide to follow the sun, as one is said to follow the moon, and differ from it only in being smaller; and when the sun and moon are in quadrature, we should expect, according to theory, that there would be four tides in a day: two caused by the moon and two by the sun, whose major axes would be at right angles to each other. When the sun and moon are in conjunction, we have the highest tides, because both act together and in the same direction. When they are in opposition, we should expect the lowest tides because they act in opposite directions and each tends to counteract the effect of the other. But in fact this combination also appears to produce spring tides.

If the tidal wave is caused by the moon, and follows her as she apparently makes a complete circuit of the earth in about 25 hours, it must travel at the rate of one thousand miles per hour, and this is hardly reconcilable with its mildness and harmlessness in dashing upon the shore, nor with Mr. Airy's law for the velocity of tidal waves, which makes

it the "same as that which a free body would acquire by falling from rest, under the action of gravity, through a space equal to one half the depth of the water." The Pacific Ocean is estimated to average 440 fathoms in depth, and according to this rule the velocity would be less than 200 miles per hour; or, by a slight change in its application, the rule would make the average depth of water over the whole surface of the earth more than twelve miles. The tidal theory supposes the anomalous condition of an interrupted ocean enveloping the whole globe. Again, if the moon or sun causes the tide, we would expect an observable uniformity in the direction and velocity of the tidal wave from the eastern borders of the Atlantic and Pacific Oceans to their western borders; but on the contrary, it is acknowledged by orthodox believers in the lunar and solar cause of tides that we have little or no clue to the course or rate of travel of the ocean tide. Even for the North Atlantic, which is constantly alive with commerce, no connection has yet been discovered between tides of the opposite coasts.

The tide on either side of the earth does not rise on the vertical between the earth and the attracting body, but, under favorable circumstances, about three hours behind it; and when these are not favorable, the retardation may be almost indefinitely prolonged. The reason of this is said to be that the inertia and friction of the water, and other causes, prevent its rapid change of form; and although the elevating force is greatest under the vertical, it still continues to act in the same direction, and with but little diminution of force, for some hours after the passage of the moon. But, strange to say, when the influences of the sun and moon are combined to overcome this friction and inertia, the interval between the meridian passages of these luminaries and the spring tide is longest of all. The retardation so varies with the depth of the sea, form of the basin, interruption of the land, etc., that confessedly no regular progressive movement of the tide wave can take place except in the unfrequented Southern Ocean. This, together with the acknowledged want of observed connection between the tides on the opposite coasts of the North Atlantic—though here subject to constant inspection—leads to the conclusion that the belief, respecting the movement of the tidal wave around the earth from east to west, is based on conjecture rather than positive demonstration. On the other hand, there are some reasons for the supposition that this wave moves in the opposite direction. Mr. John Wise, who suggests some of the objections mentioned above, claims that it moves from west to east, and is due to the action of the earth's centrifugal force, just as water is thrown forward on the surface of a rapidly revolving grindstone. In substantiation of this, he says: "The first authenticated records we have of this centrifugal wave rolling round the earth, from west to east, are given in the log of the clipper ship *Sovereign of the Seas*, in her remarkably short passage of eighty-three days from the Sandwich Islands to New York, in 1833, in accordance with Maury's chart furnished by our government. This ship made 16½ knots an hour in her easting for four consecutive days while riding this great centrifugal wave in her doubling of Cape Horn. And in the same year, by the same directions, the sailing ship *Flying Scud* made equally good castings, and made as much as 440 miles in one day, taking advantage of this fact of the great tidal wave." These statements would seem to necessitate the progressive movement of the water as well as the wave, for their explanation. But it is generally held that the water itself has little or no real forward motion.

Mr. Wise also claims that there are not two distinct daily tides in the Southern Ocean, nor at all intertropical points; and that where two appear, they are due to gurgitation and regurgitation of the water, occasioned by its forcible contact with the shores between which it oscillates, and may be influenced by the fact that the equator of the earth is an ellipse and not a perfect circle. He assigns, as the cause of their regularity, what Herbert Spencer calls the rhythm of motion, and says: "They have their elucidation in, and are manifestly referable to, that harmonious pulsation of Nature which exhibits itself in the throbbing of the heart, in the motion of the blood, the vibration of sound, the 'nodding' of the poles of the earth, in all mechanical movements, and in the measured cadence of the waterfall as it rises and falls in its musical rhythms."

That most of the objections cited herein have their stereotyped answers is not denied. But it will doubtless be conceded that there is some reasonable doubt as to their correctness, and that strict science, which rests on facts and not on theories, would not be injured by a careful revision of this whole question. With this end in view, we close our remarks as we began, with the honest query: What is the cause of tides?

Cambridge, Mass.

S. H. TROWBRIDGE.

Coughing.

The best method of easing a cough is to resist it with all the force of will possible, until the accumulation of phlegm becomes greater; then there is something to cough against, and it comes up very much easier and with half the coughing. A great deal of hacking, and hemming, and coughing in invalids is purely nervous, or the result of mere habit, as is shown by the frequency with which it occurs while the patient is thinking about it, and its comparative rarity when he is so much engaged that there is no time to think, or when the attention is impelled in another direction.

A GELATINOUS substance frequently forms in sponges after prolonged use in water. A weak solution of permanganate of potassa will remove it. The brown stain caused by the chemical can be got rid of by soaking in very dilute muriatic acid.

The New York Tribune Building.

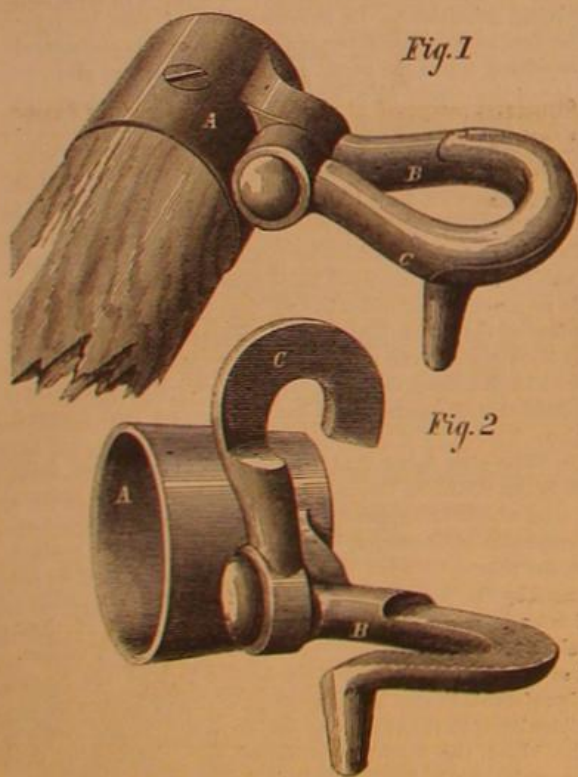
On April 10, the 34th anniversary of its commencement, the New York Tribune opened the doors of its new offices to the public. The structure is of great height and immense solidity, and is built of brick laid in cement, with dressings of stone and granite. The finial on the clock tower is 260 feet above the sidewalk, surmounting a building containing sub-cellar, basement, nine stories, and attic. The walls of the lower portion, sustaining the great weight of the masonry, are 5 feet 2 inches to 6 feet thick. The building is claimed to be absolutely fireproof. No wood is used in its construction, except for floorings, doors, and window frames; and the wooden floors are mere plankings laid over solid cement. No iron pillars are used, masonry being employed on each floor to carry the superstructure. The floors are ingeniously constructed, being flat arches of hollow concrete blocks, resting at the ends on flanged iron beams; they are made of plaster of Paris, coke dust, and the hydraulic lime of Teill. When the whole building is complete, it will certainly be an exceedingly handsome and commodious structure.

A Hoe web press is already at work in the new press room, and has a capacity of 16,000 complete copies per hour. The composing room is fitted up for one hundred compositors, and the editorial and other offices are intended to be models of comfort and convenience. Speaking tubes are used for intercommunication, and pneumatic tubes convey papers and documents between the editors' room, the counting room, and the composing room; and the elevators and heating and ventilating apparatus are all of the most modern design. The pneumatic tubes are operated by a blower placed in the basement of the building, similarly to those in the Western Union offices, an illustration of which we recently published.

SMITH'S IMPROVED WHIFFLETREE HOOK.

This is a simple device for attaching the trace to the whiffletree, and consists of a pair of sister hooks, which are arranged to open to receive the trace, and which, when closed, prevent the trace from becoming accidentally detached under any circumstances.

Fig. 1, in the engraving, shows the hooks closed, and Fig. 2 the same open. A is the ferrule, which is secured to the whiffletree in the usual manner. The lower half, B, of the hook is in one piece with the ferrule, and has a downward projecting lug on the end, as shown. The upper half, C, is pivoted sidewise to the lower half, but is bent in oppo-



site direction to the latter. Both parts are recessed at their overlapping front portions, to form, when together, as in Fig. 1, an eye for the ring of the trace. In attaching the latter, the eye is first placed over the part, B, and carried back to the rear; the upper part is then brought down, and the trace pushed forward over both.

This device, the inventor informs us, has given general satisfaction wherever used. It offers no open hook in which the reins are apt to get caught, and yet allows of the attaching or detaching of the traces in the shortest possible time. It certainly is a very simple and ingenious appliance for the purpose intended.

Patented through the Scientific American Patent Agency, February 16, 1875. For further particulars relative to sale of entire right, or with regard to manufacturing on royalty, address the inventor, Mr. O. J. Smith, Wauwatosa, Milwaukee county, Wis.

Consumption of Wood in France.

The *Independence Belge* gives some curious statistics relative to the consumption of wood in France. A large quantity of soft wood is used for making toys, and to give an idea of the magnitude of this trade it will be sufficient to take one article alone, children's drums, of which in Paris alone 200,000 are sold every month. The total number made annually in France is estimated at 80,000,000, while a considerable quantity of wood must be consumed to supply 60,000,000 drumsticks.

A CURIOUS OCULAR ILLUSION.

It is generally believed that the minute striae which appear upon diatoms, under the microscope, are in reality an assemblage of hexagons, as the striae resolve themselves into an assemblage of such figures when subjected to higher magnifying powers. M. Nabet, the celebrated French microscopist, describes, in a recent number of *La Nature*, an odd optical illusion which, he states, accounts for the figures on the diatoms appearing as hexagons, when, in reality, they are spherical in shape.

The reader can see for himself, from the diagrams given herewith, that M. Nabet's conclusion is without doubt correct. The large circular dots in Fig. 1 are drawn as nearly as possible in positions similar to those of the supposed hexa-

Fig. 1

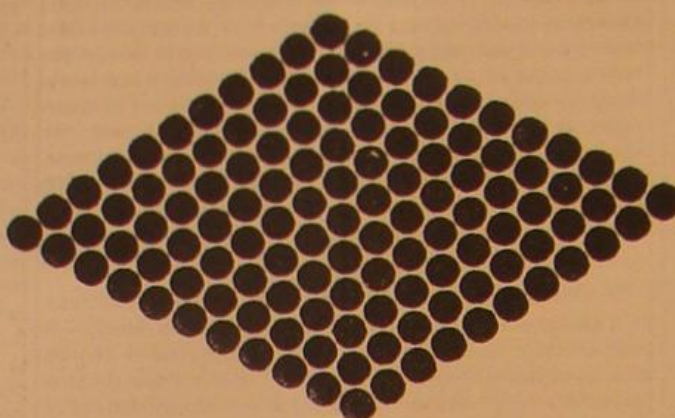


Fig. 2

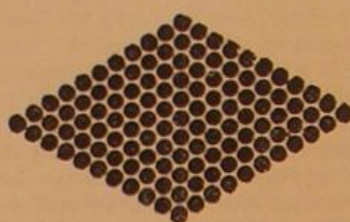
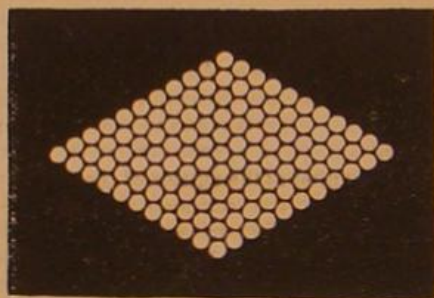


Fig. 3



gons on a very beautiful diatom, called *pleurosigma angulata*. If the figure be looked at for a moment, especially through the eyelashes, that is, with the eyes nearly closed, the circles will instantly appear as hexagons. This effect is all the more striking in Fig. 2, which is the same reduced by photo-engraving. Fig. 3 is a negative reproduction of Fig. 2, by the same process. The curious effect of irradiation is noticeable by comparing the last two diagrams, the white circles, though of exactly the same size, appearing much the larger.

Pure Sulphate of Nickel.

The salts of nickel employed in the electro-deposition of that metal are prepared from commercial nickel, which is an alloy of nickel, copper, and iron, with traces of arsenic, containing from 40 to 90 per cent of actual nickel. The author's process consists of four operations: Solution of the crude metal in acids; precipitation of the copper by iron; peroxidation of the iron, and conversion of the metals into sulphates; precipitation of the iron by carbonate of baryta, and crystallization of the sulphate of nickel. The nickel is first dissolved in seven to eight times its weight of aqua regia; the solution is evaporated almost to dryness; the residue is re-dissolved in water, using about five times the weight of the nickel employed. A little arseniate of iron remains insoluble, and is removed by filtration. Metallic iron, preferably small nails, is introduced into the hot liquid, to about the weight of the nickel employed. It is stirred from time to time to detach the copper from the iron. As soon as a piece of bright iron, introduced into the liquid, is no longer coated with copper, this process is complete. The whole is thrown on a filter, and washed repeatedly. The copper is then collected by sifting it under water, in a sieve coarse enough to let pass the coppery metallic powder, but retain the iron. The copper is dried, and is then marketable. The filtrate now contains merely nickel and iron. The latter is peroxidized, either by a current of chlorine, or by treatment with nitric acid. Sulphuric acid at 66° Baumé is then added, in the proportion of 2 parts to 1 of nickel employed, and the whole is evaporated to dryness to expel nitric and hydrochloric acids. The dry residue is re-dissolved in water, a part sometimes remaining insoluble, consisting of sub-sulphate of iron. From the solution the iron is thrown down by means of carbonate of baryta (artificially precipitated). This carbonate separates the iron as sesquioxide, and forms at the same time insoluble sulphate of baryta, without acting upon the sulphate of nickel. The last traces of arsenic are thrown down along with the sesquioxide of iron. The precipitation

is effected by gradually adding a slight excess of carbonate of baryta to the liquid, slightly heated, but not so as to exceed 50° to 60° Fah. It is complete when a further addition of carbonate occasions no effervescence, and does not become covered with peroxide of iron. Pure sulphate of nickel then remains in solution. It is separated from the precipitate by filtration, and the filtrate is evaporated till a pellicle appears on the surface, when it is set aside to crystallize.—*M. A. Terrell.*

A Varnish from Vulcanized Rubber.

The following description of a method of making a varnish from vulcanized rubber is taken from the *Moniteur Industriel Belge*. In answering questions relating to the dissolution of vulcanized caoutchouc, we have repeatedly doubted the possibility of so doing. The present process, however, seemingly includes burning out the sulphur, etc., and then dissolving the residue. If any of our readers practically test the recipe, we should be glad to learn the result.

The fragments of vulcanized rubber are deposited in a deep earthenware pot, which is closed by a tightly fitting cover and deposited on burning coals for about five minutes. During this period care must be taken not to open the vessel, as the vapor is highly inflammable. On removal, the mass is examined by pushing a wire into it to see that it is uniformly melted; and if this be the case, it is at once poured out into a large, well greased, shallow tin pan, and left to cool. When hard, it is broken into small pieces, placed in a bottle with benzole or rectified essence of turpentine, and there thoroughly shaken and stirred.

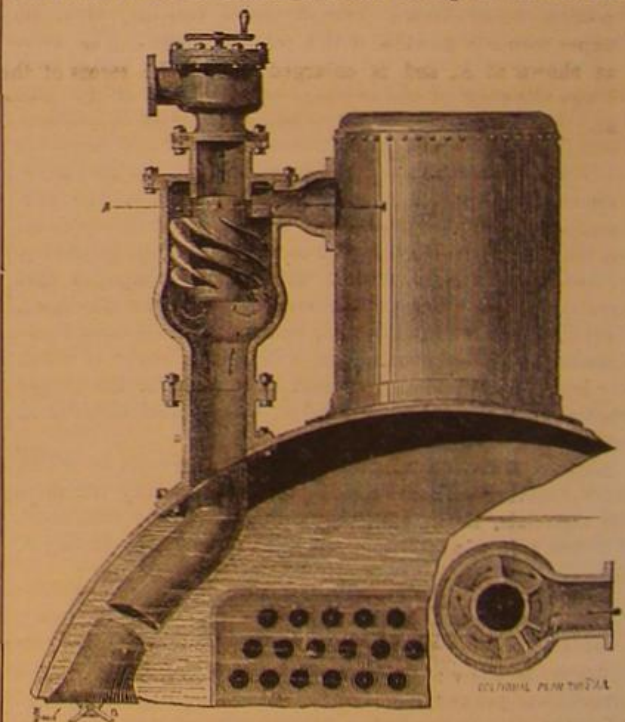
The dissolution then takes place, and after a brief rest the clear liquor which forms the varnish is decanted from the impurities which settle at the bottom.

STOCKLEY'S IMPROVED ANTI-PRIMER.

Hundreds of our readers have to complain of inefficient working done by steam engines, and of damage to cylinders (in the bore and to the heads) and pistons, all being caused by water working over into the engines in the steam. Dry steam is an absolute necessity to the engineer who desires to work economically, both in consumption of fuel and wear of his machinery.

Mr. J. Stockley, an engineer employed in the Wallsend coal district, England, has invented an appliance for securing dryness of steam, and it has, we are informed, been already applied to several marine engines with marked success.

A fixed case or pipe, C D, is put on the boiler, as shown. The steam from the dome enters the casing, as shown, and



the theory is that the helix within C causes the steam to assume a whirling motion, by which the water is expelled by centrifugal force, and falls down D into the boiler, while the now dry steam, pursuing the course shown by the arrows, rises and escapes through the stop valve above. The action will, we think, be readily understood. Flap valves, to prevent the water rising, are inserted in the pipe, C D. This invention appears to have given excellent results in practice, and it is no doubt designed on sound principles.

An Excursion to the Mediterranean.

The memorable cruise of the Quaker City, so comically described in Mark Twain's "Innocents Abroad," is to be repeated; and those who have wished to "do" Europe, after the manner recounted by that genial humorist, will this summer be offered an excellent opportunity for so doing. Mr. George F. Duncan, himself one of the original Quaker City travelers, proposes to charter a steamer and secure about 100 passengers, whom he will conduct to nearly every point of interest in the Mediterranean. The ship will sail on about the 1st of June, and the cruise, which includes visits to the Holy Land, Egypt, etc., besides affording abundant time for rambles inland on the Continent, will terminate with the arrival of the travelers back in New York on about the 10th of November. The cost of the trip will be \$1,500 currency for each passenger.

This is an excellent chance to see a large amount of the world for little money. The reader will find further particulars in the advertisement on another page.

WHIPPLE'S IMPROVED CLOTHES DRYER.

The device illustrated herewith will doubtless meet a ready welcome from laundresses, inasmuch as it tends to obviate the use of the stationary clothes line. Instead of the clothes being carried out to the line and there secured, requiring the person to emerge from a warm room, often into cold and blowy weather at the risk of incurring illness, the garments, through the present invention, are secured to lines on a simple frame, which last is then transported bodily out of doors, and set up—an operation requiring but a few seconds. The wooden frames, 5½ feet high by 4 feet wide,



are neatly strung with metallic line, the total length of the latter being about one hundred feet. At the upper left hand corner, as shown in the engraving, a hinge joins the two frames, but in such a manner as to admit of their lower portions being thrown outward, as represented. The other upper corner is provided with a recessed hinge and set screw, as shown at A, and is enlarged below, the recess of the hinge allowing of the entrance of the shank of the screw and the consequent joining or loosening of the parts as desired.

When set up, the clothes, after being wrung out, are attached, and the entire device is then carried to the drying ground and left there until the clothes are dry. This is of much convenience, since it allows of the transporting of frozen garments directly to the fire without requiring their being torn loose from the lines at the risk of injuring them, and admits of the clothes being carried immediately to shelter in case of a sudden shower.

The apparatus is readily converted into an ordinary clothes horse by loosening the screw, A, and securing the hinge, which joins the left hand corner of one frame to the right hand lower corner of the other.

For further particulars, address the manufacturer, Mr. D. B. Chapman, New London, Conn.

The Recent Life-Saving Dress Trial in England.

We mentioned recently the remarkable performance of Captain Paul Boyton in making his way to land after having jumped overboard from the steamship Queen, while that vessel was yet two and a half miles distant from Cape Clear, through the support of a life-preserving dress, to exhibit which was the object of his transatlantic voyage. A storm arising, the efficiency of the invention was put to a severer test than the wearer contemplated; but though he was kept in the water some seven hours, during which period he traveled thirty miles, Captain Boyton reached shore in safety, and this despite a terrible buffeting from the breakers.

Since his arrival in England, Boyton has given several exhibitions of the life-preserving capabilities of his dress in the Thames river, attracting large crowds of people, as well as the examination of the Royal Humane and other societies.

The latest test to which the invention has been subjected is certainly a crucial one; and although its wearer failed to accomplish completely the task which he had set himself, sufficient, nevertheless, was done to warrant the pronouncing this device to be certainly one of the most efficient of life-preserving apparatus yet produced. Captain Boyton undertook to float from Dover to Boulogne, crossing the English Channel and accomplishing a distance of over fifty miles, within one day. The darkness of the night and inclemency of the weather, coupled with an error on the part of his pilot in not directing him a straight course, prevented the fulfillment of the undertaking; but as it was, the swimmer, after remaining in the water fifteen hours and reaching a point within eight miles of his destination, emerged with clothes dry, temperature of body lowered but one degree, pulse at eighty, and fully capable, according to medical opinion, of remaining afloat at least six hours longer. A repetition of the effort will undoubtedly bring success, though to all practical purposes the same has already been achieved. The credit, however, must in no slight measure

be awarded to Captain Boyton's powers of endurance, as it is evident that, while the dress furnished buoyancy for the period above named, it had nothing to do with the rapid propulsion of the individual over the water.

We notice that several of our contemporaries fall into the mistake that the invention is a very recent one. This is not the fact, since it is nearly six years ago that it was patented through this agency, by its inventor, Mr. C. S. Merriman, both in the United States and in most of the foreign countries. In our issue of January 14, 1871, a fully illustrated description of the device appeared, together with an account of its successful exhibition off the Battery in this city.

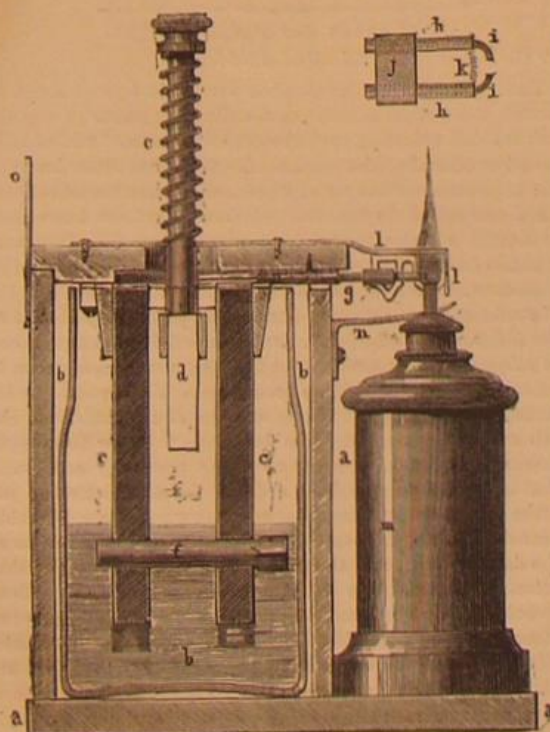
The efficiency of the invention now being proved, it remains to see how long before the steamship companies will defer its adoption. The objection of occupying valuable space cannot be urged against it, inasmuch as it can be folded into the compass of an ordinary overcoat; nor is its cost, probably, to be compared with that of much more common and more elaborate life-preserving apparatus. With the record of its qualities now well known, it certainly appears that the knowledge of such a means of safety being on board would do much to lessen the terrors of the sea to the traveling public, and at the same time, as a necessary consequence, to increase the receipts of steamship lines.

IMPROVED ELECTRIC LAMP LIGHTER.

The lamp-lighting device shown in our illustration is called "the electro-catalytic lamp lighter, and is brought out by Messrs. Voisin & Dronier, of Paris, France. It resembles, in its general features, the well known Döbereiner apparatus, in which hydrogen gas is used to heat platinum sponge. In this case, the igniting material is a thin platinum wire, heated to glowing by an electric current passing through it, and thus igniting a wick, the lower part of which is immersed in benzine which continues to burn until extinguished. Fig. 1 shows the apparatus in sectional side elevation, and Fig. 2 shows the igniting wire in its actual size.

The glass vessel, *b*, is placed in an inclosing casing or box, and is provided with a galvanic element attached to the detachable top, the long carbons, *c*, reaching down into a solution of bichromate of potassa and diluted sulphuric acid, which fills the vessel, *b*, up to a certain point. A zinc plate, *d*, is suspended between the carbons by a sliding spring-actuated rod, *e*, guided in a perforation at the top, and depressed by a button at its upper end; so that, when depressed, the zinc plate is immersed in the solution till it comes in contact with a lateral carbon connecting stop, *f*. At the under side of the lid of the vessel are applied two parallel copper wires, *g*, in contact with the sliding rod and the carbons, for transmitting the electric current (produced by the immersion of the zinc) to the igniter at the outside of the casing.

The igniter (Fig. 2) is composed of two copper tubes, *h*, placed on the ends of the wires, *g*. The copper tubes are laterally connected by an insulated brace sleeve, *j*, and have, at their front end, small rods, *i*, which approach each other. These small rods are connected by the spiral platinum wire, *k*, which is protected against injury by a perforated guard piece, *l*, attached to the lid and extended over the igniter. The length and resistance of the platinum wire



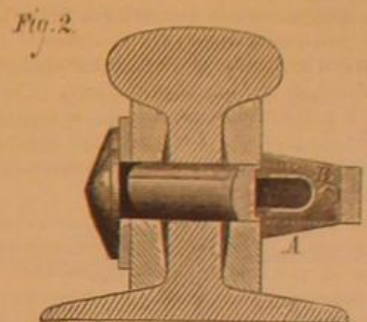
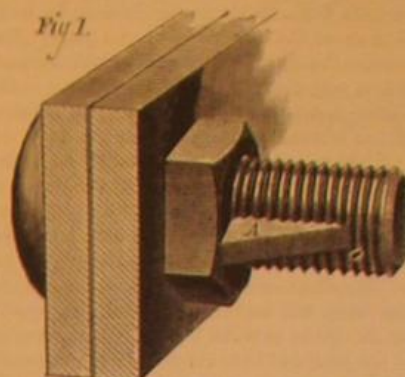
have to be determined in proportion to the galvanic element, and if the wire is of proper length, it will be heated brightly when only one fourth of a square inch of the zinc is immersed in the solution. The lamp, *m*, which is filled with benzine, is placed in front of the apparatus so that the wick is just below the platinum wire, but does not touch it. The lamp is attached to the base of the apparatus, and can be refilled by unscrewing the top part, the wick being held by a forked guide piece, *n*, in the exact position required for ignition.

The whole apparatus can be hung by the ring, *o*, to the wall, or applied in any other suitable manner. The battery solution is sufficient for about 500 ignitions, while the gal-

vanic elements allow about 15,000 before renewal is required.

A NEW LOCKING BOLT.

In the annexed engraving we illustrate a new and simple locking bolt, such as is used for connecting fish plates with railroad rails, irons of railroad bridges, and for like purposes. The novel feature is a mortise made near the outer end of the bolt and through the same, in which two arms or dogs, *A*, in the sectional view, Fig. 2, are pivoted to a common center, *B*. Between the arms is arranged a U-shaped spring, which throws them outward. In pushing the bolt through the aperture, and in applying the nut, the arms are easily shoved into the mortise; but when the nut is in place, as in Fig. 1, the arms are thrown out by the spring, their



square shoulders thus locking the nut. The device was patented January 20, 1874, to Mr. J. C. Tiffany, of Portsmouth, N. H.

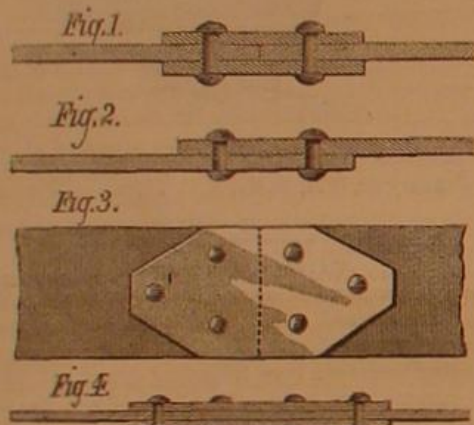
Riveted Structures.

Structures composed of several parts must mainly depend, for their strength and stability, upon the joints or means of connection between them. Thus, in a wrought plate girder, the riveting becomes a very important element of strength, and no correctness of mechanical design or sectional area of parts will avail, if one of the joints happens to be defective or weak. Every joint should, in fact, be equally as strong, at the least, as the material or parts connected, for it is very clear, if it were not so, the sectional areas of the plates or pieces would only be partially called into requisition, and, in fact, the structure would be no stronger than its weakest joint, or its stability would be measurable by the strength of its joints. Taking, for example, a cylindrical boiler, its effective strength to resist the pressure of steam would only be that of its weakest riveted joint, as we are all occasionally made aware of under the distressing circumstances of boiler explosions. This point, in fact, cannot be too strongly insisted upon, for it is obvious that, in constructing such works, there is a tendency to regard the general form, and not every detail; or in other words, the joints and minute connections are only thought of collectively. In every structure required for active stability or strength, the details require equal attention and care to that of the general design. As regards iron plates or boiler plates, it is known they have less tensile strength than the same iron made into bars. This is due chiefly to the process of rolling iron into plates of such thinness; and it is also found that a boiler plate is less tenacious across the fiber than in its direction; its greatest strength being about 20 to 22 tons per square inch, while its least strength in the transverse direction is about 19 tons per inch of section. In making cylindrical boilers, therefore, it is evidently desirable to put the plates in their strongest direction round the boiler, so that the transverse pressure, which is always the greatest, should have the strongest direction of the plates. It is seldom found that boilers give in their longest direction, and a cylindrical boiler is calculated to have about double the strength in that direction to what it has transversely under a given uniform pressure of steam. The circular or cylindrical form of boiler is the strongest, and has superseded the rectangular form with flat surfaces. It is easily seen that a circular form is the best for resisting uniform pressure. For the plates, though wrought iron is commonly used, steel is rapidly coming into use. The relative strengths of iron and steel are as follows:

Iron.....	50,000 lbs.
Steel.....	90,000 lbs.

From which it is seen that steel has nearly double the strength of wrought iron. The recent boiler explosions which have startled the public will, we believe be the means of introducing to a greater extent than hitherto the claims of steel for boiler plates. Let us further examine the conditions of strength in boiler construction; and first as regards the materials and joints: We may here casually refer to the advantage that would arise, in reducing the risks of the calamitous accidents we are constantly hearing of, if periodi-

cal tests were instituted by government authorities by the application of hydraulic or steam pressure of double the usual working pressure.* It is very evident that the strength of a boiler depends, first upon the resistance to tearing of the plates, and secondly upon the resistance to shearing of the rivets. New plates may tear along the line of rivet holes, or by the detrusion of the pieces of plate between the holes and the edge of plate. In this case, the resistance is measured by the shearing strength of the plate per square inch, multiplied by the number of pieces detruded or pushed out. We have already shown that the tenacity of boiler plate is about 20 tons per square inch. As regards rivets, the shearing strength may be taken as the same; 22 tons is considered the average, however, for best Yorkshire iron. We have next to consider how the riveting can be made to equal in strength the plates, so as to obtain the greatest amount of strength from both. This is usually done by making the rivet equal to twice the thickness of the plate. Then the pitch or distance from center to center of rivets must be considered, as it is very clear, if this distance is not sufficient to make the plate between two rivet holes as strong as the rivet itself, no advantage is gained, as the least resisting will give. Thus, in a single riveted joint, the breadth should be at least equal to three diameters of the rivet, and the pitch should also be three diameters. The plates at the lap joint are double, hence are equal in strength to the rivet; and the distance from the rivet hole to the edge of the plate must be one diameter, hence the whole width of the joint from center of the rivets will be three diameters, as above stated. There must, it will be seen, be a diminution of the effective strength of the plates in thus riveting them together, equal to the amount of metal punched or drilled out, which is one third. This diminution in the strength must be carefully considered, and precautions taken to lessen it as much as possible, either by increasing the number of shears to which a joint is liable, or by drilling the holes. Thus, a double shear rivet is considered twice as strong as a single shear one; and to make the joints equally strong the single shear joint should have twice as many rivets as the other. Fig. 1 shows



a double shear rivet, and Fig. 2 a single one. When plates are in tension, the aggregate shearing area of the rivets on each side of the line of joint, multiplied by the safe strain to shearing per inch, should equal the total working strain on the plates. In some joints, as in girder plates, the collective shearing area of the rivets should be nearly equal to the effective plate area. In practice, the rivet area is made about $\frac{1}{3}$ greater, to compensate for any inequality in the strain. "In steel plating," observes Mr. Bindon Stoney, "the rivet area of the rivets in steel should be one third greater than the net area of the plates, but the heads of steel rivets are very apt to fly." Mr. Hodgkinson deduced from experiments that the "strength of plates, however riveted together with one row of rivets, was reduced to about one half the tensile strength of the plates themselves; and if the rivets were somewhat increased in number and disposed alternately in two rows, the strength was increased from one half to two thirds or three fourths at the utmost. For the relative strengths the following may be taken:

Strength of an unpunched plate, 100; strength of a double riveted joint, 66; strength of single-riveted joint, 50. Punching, it would appear, reduces the tensile strength of iron to a greater degree than the entire area of metal punched out. It has been stated that drilled plates are 15 per cent stronger than punched ones. The preceding remarks apply to girder and boiler riveting. We give here the rules adopted by boiler makers. For plates less than $\frac{1}{2}$ inch thick, the diameter of rivet equals twice the thickness of the plate. For plates more than $\frac{1}{2}$ inch thick, the diameter of rivet equals once and a half the thickness. The pitch of single joints equals $2\frac{1}{2}$ to 3 diameters, and that for double joints equals $3\frac{1}{2}$ to 4 diameters. The lap for single joints equals 3 diameters, and that for double joints 5 diameters, of the rivet. While in boilers the distance between the holes and edge of plate is 1 diameter, in girders it is seldom less than $1\frac{1}{2}$ times diameter of rivet, and the pitch varies from $2\frac{1}{2}$ to 5 or 7 inches. Some joints, as in girder work have covers or plates riveted on one or both sides; these covers should equal in strength the plates. See Fig. 3, which shows an economical arrangement of tension joint. Another resistance must be noticed, which tends to increase that of the riveting, namely, that due to the contraction of the rivets when cooling. This frictional resistance does not, however, when added to the rivet's resistance, quite equal that of the plates, though much stress is placed upon it by engineers.

Various ingenious devices have been proposed to obtain a uniform strength both in the plates and joints. Oval rivets

have been suggested, in which a greater area is left between the holes by putting the narrowest part of the rivet in line with the joint, the longest diameter being placed in the other direction. Thus a $\frac{1}{2}$ inch round rivet may, as far as its strength goes, be transformed into an oval one of the same area of section and strength; but the hole being reduced in the direction of the joint or weak line of the plate, greater advantage would result, because the plate could be made so much stronger. Oval holes may as easily be drilled as round ones, and it is not improbable this mode of riveting will supersede the ordinary kind for boilers before long.

Sir W. Fairbairn proposed rolling the plates with thicker edges along the rivet holes so as to approximate the strength of both; this, too, is a feasible suggestion. Another equally good plan is to arrange the plates and joints diagonally, the joints being at an angle of 45° with the axis of boiler. By this plan the strength of the boiler is increased considerably, according to Mr. W. R. Browne, in the ratio of four to five.

In good boilers the joints that have to resist the greatest strain, the circumferential, are double-riveted, while those subject to longitudinal strain are single-riveted. Even this precaution, however, does not make the joints so strong as the plates by a ratio of one fifth.

Correspondence.

The White Streak in Silk.

To the Editor of the Scientific American:

I am aware that manufacturers have been more or less troubled with the appearance of a white streak on machine twist, and that dyeing by the ordinary process for silk would not color it. It is alleged that it may arise from not thoroughly washing the material from soap; or it may arise from dead wood, or from adulteration, or from a parasite or fungus. That it is not soap, every dyer knows. That it is not a parasite or fungus is evident, because an ordinary thread of twist contains about 15 threads as reeled, and each thread about 5 as spun by the worm, so that the aggregate is 75 threads. Were it a parasite or fungus, it would be a spot only on 1 thread of the 75, and the other 74 threads would wrap round it, and it would be lost to view. No silk made on mills where the spindles are run with leather belts and the silk is taken up on shaft bobbins, and is not stretched on the stretchers now in use, ever developed the so-called white streak.

That it is a vegetable substance is shown by the fact that the process for dyeing cotton, flax, or woody fibers colors it; but the process for silk, wool, feathers, or other animal substances will not color it.

The friction rolls on spinning mills are continually wearing, by friction with the silk. The bands are whipped and worn, at the knots, into fine threads flying around the spindle; the wood rolls of the stretcher are constantly wet and softened, and are subject to friction, giving off fine particles. All these latter are taken up more or less by the thread; and it is from this source the trouble must be looked for.

I would like to confirm the statement that it is found on raw silk by boiling and dyeing; then if the streak remains, I will admit that there is something in the theories of adulteration, parasite, or fungus.

LEWIS LEIGH

Mansfield Center, Conn.

A Remedy for Potato Blight.

To the Editor of the Scientific American:

Having read a communication from Mr. Lyman Reed, of Boston, some months since, concerning the cause of the potato rot, and referring the process to the action of microscopic parasites attacking the tubers, I devoted some spare hours to the verification of his view, which, with some modifications, I am compelled to indorse. My investigations have been conducted with an instrument magnifying 800 diameters (640,000 times), assisted by a dissecting microscope giving 50 diameters, for the preparation of sections and the isolation of specimens. My method has been to procure specimens of the different varieties, and, having carefully cleansed them, to subject them to gentle heat for 96 hours or more, then to submit them to a careful examination. The ova of the insects seem to occupy the interior layer of the cuticle of the tubers, and pass rapidly into larval state under the proper thermal condition. I have no doubt that they commence that histolytic process that ends in the destruction of the tuber; but I doubt whether there is any genetic connection between the fungi developed on the stalks in the course of the degeneration, and the larvæ, in which the degeneration primarily starts. The fungi are very likely independent structures resulting from the deposition of spores from the atmosphere, on vegetable tissue already in the course of dissolution from other causes. Indeed, I may say that from actual examination I am assured that such is the case, and that, as a general rule, vegetable tissues develop microscopic fungi in the process of breaking down, where similar spores deposited on healthy tissue would remain undeveloped.

I have made drawings of the larvæ mentioned by Mr. Reed, in their various stages, and, what is more important, have tested them with various re-agents. Tested with weak solution of sulphuric acid, they become very active for a few minutes, then fall into a torpid state, but finally recover. Substantially the same effect is produced by alcohol. Ordinary whale oil attacks them virulently in the larval state, but not so virulently in the less developed stages. Kerosene oil is still more fatal to them in the larval state; but unless a considerable quantity is absorbed they gradually recover, and the younger the larvæ the less readily they yield to the action of kerosene. In some experiments prosecuted last

summer on what are generally known as apple tree worms, the same rule held good. Spermin oil and kerosene were both destructive to the fully developed larvæ, but very inefficient when applied to the undeveloped ova. After thoroughly testing the potato larvæ in their various stages, with solutions of nitric, muriatic, sulphuric, and oxalic acids, then with alcohol, spermin oil, and kerosene, and with various alkalis, and finally with iodine tincture, I was forced to the conclusion that the remedy was not to be sought in this direction, and tried a combination of one part of carbolic acid to thirty parts of common whale oil, with unerringly destructive results, both as respects the larvæ and the ova.

If you will permit me, on a subject of such importance, through your universally read journal, I will take the liberty of announcing that a bland solution of carbolic acid in common whale oil or kerosene is the scientific remedy for the rot. The best way to use it would, I think, be to dip the potato, just before planting, in the solution, which is very inexpensive and very easily obtained. I may add that my experiments convince me that carbolic acid in this bland solution in no way impairs the germinal activity of the tuber; but, by way of certainty, let me recommend your farmer readers to first try the experiment on a few hills this spring, and, if successful, to adopt it as a remedy for the blight.

I will, should you signify that it would be agreeable to you, be glad to give you full details of my investigations, accompanied with drawings of the insects in different stages, and descriptions of structure and manner of development from the egg, of which I have copious notes: according always to Mr. Reed the full honor of first discovery.

New York city.

FRANCIS GERRY FAIRFIELD.

The Flow of Water in the Suction Pipes of Pumps.

To the Editor of the Scientific American:

In reply to your many correspondents who ask about (and are pleased to commend) my recent article (in "Practical Mechanism") on the subject of pump suction pipes, I would say that the result of my experience has been that, by allowing the flow of water through suction pipes to be 300 instead of 500 feet per minute, the following increase in the ratio of efficiency of the pump is attainable, and carefully conducted tests show it to be correct: Under a 27 feet lift, 15 per cent; under a 15 feet lift, 7 per cent; under a 5 feet lift, 2 per cent.

I account for this increase of efficiency as follows: Since the area of a circle increases as the square of the diameter, the friction of the water is, proportionally to its volume, less in the larger pipe. The check given to the upward movement of the water (in the suction pipe) by the pump piston (when it reverses its motion at the end of the stroke, and before the suction valve has had time to close) is experienced to a less degree upon the larger than upon the smaller body of water contained in the suction pipe. The larger suction pipe holds a proportionally larger supply of water close to the pump barrel, and serves in the same way as does a steam chest to a steam engine, to increase the volume of the supply. The increased efficiency, due to the application of an air chamber to the suction side of a pump, is in part, if not wholly, due to the same principle. The presence of air in communication with the suction pipe is neither desirable nor obtainable in a continuously working pump, because the water in time absorbs all the air, and fills the chamber which contains it. That vessel may therefore be more correctly termed a supply reservoir. In the experiments referred to above, there was one bend or elbow in the suction pipe immediately outside the pump barrel, and the water was received into a reservoir in the pump and directly beneath the suction valves, which were of rubber and of the kind known as griddle valves. They were as large in area as the barrel of the pump; the reservoir referred to was about two thirds as large in cubical contents as the pump barrel, and (as a consequence) but very little difference in the ratio of the efficiency of the pump was observable, whether the suction pipe was supplied with an air chamber or not, excepting at the 27 feet lift test, at which the application of the air chamber increased the efficiency about 3 per cent. The number and radius of the bends in a suction pipe affect the efficiency of the supply of water to a serious degree, as the greater their number, and the less the radius of each bend, the larger should be the area of the suction pipe. These conditions are, however, so variable that but little would be added to our present knowledge upon the subject by making tests, unless under a multiplicity of those conditions.

I stated, in the article on pumps, that "all pumps show less water than their capacity, the deficiency ranging from 20 to 40 per cent, according to the quality of the pump. This loss arises from the lift and fall of the valves, from inaccuracy of fit or leakage, and in many cases from there being too much space between the valves and piston or plunger." To this latter remark, I would now add that, in cases where the defect referred to exists, I have increased the efficiency of the pump as much as 25 per cent by simply filling in the vacant space with lead, first boring a few holes in the metal for the molten lead to run in, so as to prevent the lead from moving when cold. It is of vital necessity to keep the space between the pump plunger or piston and the valves as small as possible, filling in all corners and allowing only room sufficient to allow the latter to open to the necessary distance.

JOSHUA ROSE.

279 West 12th street, New York city.

SAWDUST, mixed with any resinous substance, cut in small cakes and dried, makes good fire lighters, and saves kindling wood.

* Testing by steam would be, however, rather hazardous.

PRACTICAL MECHANISM.

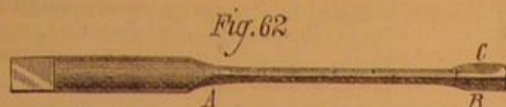
BY JOSHUA ROSE.

NUMBER XXII.

HAND TURNING.—FORGING DRILLS.

Here it will be as well to give instructions as to how to forge the drill. First heat the steel wire slowly, otherwise the extreme point will become heated before the rest of the drill; and bear in mind that the steel must not be made hot enough to scale, that is to say, it may be made to a bright red but not in any case to a yellow heat, for at that heat it will become what is called burnt, by which the virtue of the steel will be destroyed, and it will fall to pieces when struck by the hammer. But there is a stage of overheating in which the steel, while not sufficiently burnt to cause it to crumble in forging, will yet be sufficiently deteriorated to nearly destroy its value as a cutting tool, and the only way to avoid this evil is to heat the steel slowly and evenly to a bright red.

In forging the steel down to the required size, hammer it square, that is, forge it into a square bar to prevent it from becoming hammered hollow, or splitting, as it is almost sure to do if hammered all over its circumference; and take care at first to forge the point least, so as to leave a body of metal there which will tend to prevent the steel from splitting. By following these directions, the shape of the drill, when forged down to the required size and ready to be rounded up and finished, will be as shown in Fig. 62.



The corners of the square part, from A to B, may then be hammered down, making the stem round; and the bulbous end, C, may then be forged to the required finished size. A side view of such a drill is shown in Fig. 61, and Fig. 63 presents an edge view.



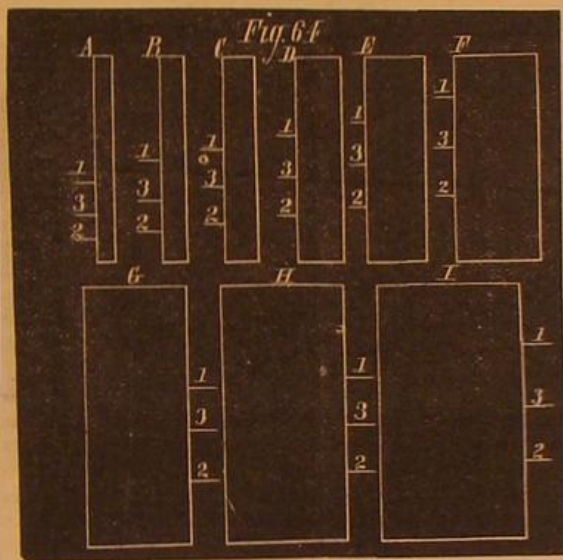
HARDENING AND TEMPERING.

Our next duty is to harden and temper the cutting end of the drill. Steel is said to be hardened when it is as hard as it is practicable to make it, and to be tempered when, after having been hardened, it is subjected to a less degree of heat, which partly but not altogether destroys or removes the hardness. The degree to which this tempering is performed, or in other words the degree of the temper, is made perceptible and estimated as follows: By heating a piece of steel to a red heat (not so hot as to cause it to scale), and then plunging it into cold water and allowing it to remain there until it is cold, it will be hardened right out, as it is termed, that is, it will be made hard to the greatest practicable degree. If it is then slowly reheated, its outer surface will, as the temperature increases, assume various shades of color, commencing with a very light straw color, which deepens successively to a deep yellow, red, brown, purple, blue, and green, which latter fades away as the steel becomes heated to redness again, when the effects of the first hardening will have been entirely removed. It becomes apparent, then, that the colors which appear upon the surface of the steel denote the degree to which the tempering or softening operation has taken place. Having then by practice ascertained the color which denotes the particular degree of hardness requisite for any specified tool, we are enabled to always temper it to that degree, sufficiently near for all practical purposes. It is undoubtedly true that, if the conditions of tempering which will be laid down in all our instructions are (for want of sufficient experience in the operator) varied, the colors will not present, to positive exactitude, the precise degree of temper; the difference being that, if the color forms very rapidly, the tool may be left of a lighter color; and that if the colors form very slowly, the tool may be left of a slightly deeper hue. The difference in temper, however, as compared to the color, will in no case be sufficient to be perceptible in ordinary tool practice, and need not, save under circumstances requiring great minuteness in the degree of temper, be paid any attention to.

When a tool (such as a drill) requires to be tempered at and near the cutting edge only, and it is desirable to leave the other part or parts soft, the tempering is performed by heating the steel for some little distance back from the cutting edge, and then immersing the cutting edge and about one half of the rest of the steel, which is heated to as high a degree as a red heat, in the water until it is cold; then withdraw the tool and brighten the surface which has been immersed by rubbing it with a piece of soft stone (such as a piece of a worn-out grindstone) or a piece of coarse emery cloth, the object of brightening the surface being to cause the colors to show themselves distinctly to indicate the state of the steel. The instant this operation has been performed, the brightened surface should be lightly brushed by switching the finger rapidly over it; for unless this is done, the colors appearing will be false colors, as will be found by neglecting this latter operation, in which case the steel after quenching will be of one color; and if then wiped, will appear of a different hue. A piece of waste or other material may of course be used in place of the hand. The heat of that part of the tool which has not been immersed will become imparted to that part which was hardened, and, by the deepening of the colors, denote the point of time at which it is necessary to again immerse the tool and quench it altogether cold.

The operation of the first dipping requires some little judgment and care; for if the tool is dipped a certain distance and held in that position without being moved till the end dipped is cold, and the tempering process is proceeded with, the colors from yellow to green will appear in a narrow band, and it will be impossible to directly perceive when the cutting edge is at the exact shade of color required; then again, the breadth of metal of any one degree of color will be so small that once grinding the tool will remove it and give us a cutting edge having a different degree of temper or of hardness. The first dipping should be performed thus: Lower the tool vertically into the water to about one third of the distance to which it is red hot, hold it still for about sufficient time to cool the end immersed, then suddenly plunge it another third of the distance to which it is heated red, and withdraw it before it has had time to become more than half cooled. By this means the body of metal between the cutting edge and the part behind, which is still red hot, will be sufficiently long to cause the variation in the temperature of the tool end to be extended in a broad band, so that the band of yellow will extend some little distance before it deepens into a red; hence it will be easy to ascertain when the precise degree of color and of temper is obtained, when the tool may be entirely quenched. A further advantage to the credit of this plan of dipping is that the required degree of hardness will vary but very little in consequence of grinding the tool; and if the operation is carefully performed, the tool can be so tempered that, by the time the tool has lost the required degree of temper from being ground back, it will also require retempering or reforming.

The distance a tool requires to be heated and dipped at the first dipping, and the distance to which the transient dipping should be performed, vary so much with the substance of the metal that a definite idea can only be obtained by an



illustration, as shown in Fig. 64, A, B, C, etc., representing pieces of steel, either round or square, the line marked 1 being the distance to which the steel is made red hot, the line 2 (in each case) representing the distance to which the first dipping should be made, and the line 3 representing the distance to which the sudden and transient plunging should be performed.

Having tempered our drill according to these rules, to a dark purple, our next operation is to grind it. The flat sides of the cutting end should be ground on that side of the stone on which the latter is running from you, the faces being ground to a gradual level, of which the extreme point is the thinnest part. The thinner the point is, the more easily the drill will enter the metal, and, but for the liability of its breaking, it might be ground almost to a sharp edge. The correct thickness cannot be determined because it increases with the size of the drill; but a very little practice will enable the artisan to estimate it for any size of drill.

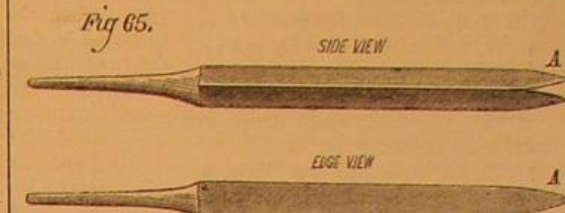
The angle of one cutting edge to the other varies with the kind of work upon which the drill is to be used, the rule being that, for ordinary work, a right angle will suffice; but for drilling sheet metal a more acute angle should be employed, so that the drill will emerge from the work gradually; otherwise, when, by reason of the point having emerged, the drill is released from the pressure necessary to force it into the metal, the remainder of the cutting edge will enter the metal very readily, and, taking an excessive cut, will twist or break the drill. For this reason the drill should be fed to its cut very slowly after its point has come through. Care must be taken to grind the drill so that the point is in the exact center of the diameter, otherwise the drill will bore a hole larger in diameter than itself; and the angle of the cutting edge should be equal on each side of the point, or else one cutting edge only will perform any duty. The angles should be ground with the grindstone running towards you, the flat side of the drill being rested upon the grindstone rest. When the drill is placed in the lathe ready for operation, it may easily be made to run true by tapping it lightly with a hammer.

Small drills may be run very fast in the lathe, which will cause them to cut freely, and to drill the hole straight; if, however, the metal to be drilled is unusually hard, the speed must be reduced.

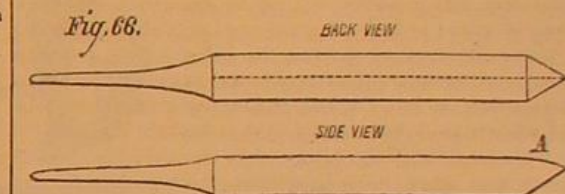
SQUARING THE ENDS OF THE WORK.

The work being centerdrilled, it must be placed in the lathe, with a driving dog on one end, the back center being screwed up only just so tight that the work may be moved

by the fingers, and yet it must have a firm bearing against the lathe centers. The hand rest should then be placed as close to the work as possible without touching it, when the ends of the work must be trued up. The object of first truing the ends is to prevent the centers in the work from wearing on one side more than the other, as they would do if one side of the end face of the work was, at either end, higher than the other. The operation is called "squaring the ends" and is performed with a side tool, of which there are two kinds, both being made of three-cornered (or three-square, as it is generally termed) steel, the only point of difference being in the manner of grinding them. A worn-out saw file is an excellent thing to make a side tool of, because the teeth grip the rest and prevent the tool from slipping. It is not necessary to soften the file at all, but (for either kind) merely to grind it as shown in Figs. 65 and 66. A being in each case



the cutting edge. The tool shown in Fig. 65 has two cutting edges, one of which rests upon the hand rest while the other is cutting, which does not in any way damage the edge but causes the tool to hold very firmly to the rest, and hence to turn very true. It possesses the further advantages that it cuts very freely, and that its point can, by rea-



son of its thinness, approach much nearer to the center of the work without coming into contact with the lathe center. Except for heavy work, it is by far the best tool in every respect, nor would the other have been presented at all, save that it is very largely employed when it is required to perform heavy duty. Both of these tools are slightly rounded in the length of their cutting edges, and are kept sharpened from the end about half an inch back.

If their cutting edges are smoothed by the application of an oilstone, they will give a very clean and smooth polish to the work. The rest should be set at such a height that the cutting edge of the tool is slightly above the horizontal center of the work; and the tool should be so held that its side face stands nearly parallel with the end face of the work, the cutting edge being held slightly inclined towards the work, which will give to the tool edge the necessary clearance. Any excess of this inclination renders the tool liable to turn out of true, and destroys its cutting edge very rapidly. Having squared each end of the work, it must be taken from the lathe, and the burr left by the turning tool around the center filed off, when the work will be ready to countersink, that is, to bevel off the edge of the hole made by the centerdrilling, and thus to form a recess in which the lathe center will fit. And here it becomes necessary to explain one of those fine points for which the purely practical man is apt to sneer at the theoretical workman. Nine out of ten practical men will countersink by simply centerpunching, or else neglect the operation altogether, and force up the back center of the lathe and thus wear a countersink in the work. The wear and damage caused to the lathe center is sufficient condemnation of this system, unless it be applied to work that requires to be reduced in size regardless of its being either true or uniform, and this should be done in a lathe used only for such work. Countersinking by centerpunching will answer very well for jobs that require sufficient work to be performed on them at each end to give them time to wear and fit the center; and as this is nearly always the case, this system is considered sufficient for all practical purposes. It is, however, mechanically incorrect, because (even supposing the artisan to be able to grind the centerpunch true so far as roundness is concerned, and true in its bevel with relation to the bevel of the lathe center), unless he holds the centerpunch so that the center line of its length is dead true with the center line of the work, the countersinking will be deeper on one side of the work than on the other, and hence will throw the work out of true. It will, however, right itself after running a little time in the lathe. Now it is quite true that the amount to which the work will thus be thrown out of true is very slight, and (as stated) soon rights itself; but even when the end of the work running on the still or dead center has worn itself true, it must be turned end for end in the lathe before the other end will become true. Then, again, when there are many pieces of work to countersink, that operation may be as quickly performed by means of the square center as with the centerpunch, while the square center will cut true and uniform. The only possible claim that countersinking by centerpunching can possess is the saving of the time required to place the square center in the lathe; for after it is once placed there, the operation may be as quickly performed in the one case as in the other.

Countersinking by the square center is performed by making the square center the running center of the lathe, and by feeding the work up to it by the back lathe center, as described in the instructions upon centerdrilling.

MOVABLE FRONTS FOR BUILDINGS.

We illustrate herewith a method of throwing open, if need be, the entire front of an apartment, which, in view of the approaching warm weather, is quite timely, since it is applicable to a number of cases readily suggested. Our artist has represented the device applied to a butcher's store, to which it is especially suited, inasmuch as it allows of doors and windows being slid completely out of sight, leaving nothing but the pillars or other necessary supports of the building above, and so affording thorough ventilation, broad access, and every opportunity of displaying stock. It might also be arranged in the edifices used as summer concert gardens, so as to leave, on warm nights, merely the roof and its sustaining posts: or in country houses, which thus could be opened so as to allow of the thorough circulation of the air. The additional advantage is also presented of doors, framework, and windows being put altogether out of the way, and protected from danger of breakage, while, at the same time, always remaining ready for prompt return to their places.

In Fig. 1 the door and fan light are shown in their usual locations. Both, however, are hung in framework, which traverses guide rails, which extend up and down toward the story above and into the basement or cellar. The frames are suspended by cords which pass over pulleys into the hollow side pillars, and which sustain counterweights, by which the balancing of the frames and their contents is effected. Thus arranged, the door, as shown in Fig. 2, may be pushed downward into the cellar, while the fan light may be raised into the wall of the upper story. When the door frame is down, a foot plate is laid upon the sill, over the opening, so that the latter is covered and concealed. The foot plate is also similarly located when the frame is up, in order to prevent the same being lowered when the doors are shut, except by first removing the plate.

The doors and fan light are hung and may be used in the ordinary manner, and the arrangement of the device for windows or portions of the wooden wall of a light building is precisely similar. If desired, the weights may be omitted, and the raising and lowering effected by suitable gearing. Also any desired locking devices may be added for holding the frames in either position.

The invention was patented January 26, 1875, to Mr. John Murphy, of Fond du Lac, Wis., who may be addressed for further particulars.

IMPROVED ROTARY PUMP.

In the annexed illustrations we present sectional views of a new rotary pump, in the construction of which there are several novel features which will render it of especial interest to the mechanical reader. Of these perhaps the one most prominent is that of the entire capacity of the pump cylinder being utilizable, instead of merely the annular portion without the eccentric ring, as is commonly the case. Both compartments, exterior to and interior of the ring, are filled and emptied at every revolution, and this whether the speed be fast or slow, as it will be seen, further on, that the motion, and consequently the operation, of the machine is essentially positive. Stuffing boxes are avoided by rendering the apparatus self-packing, and by suitable construction the working parts are balanced, equalizing the pressure on all portions. It is claimed further that the pump delivers a steady stream, forcing the same, without leakage, to any desired height, and this without necessitating the machine being driven at the high velocity peculiar to many rotary pumps. The volume of water discharged under all conditions is stated to be exactly proportionate to the power and speed applied.

In Fig. 1 is shown a vertical longitudinal, and in Fig. 2 a transverse, section. In the latter illustration, A is a portion of the casing, on the interior of which is cast the ring, B, the depth of which is greater than the outer portion of casing. The other side of the cylinder is formed by the disk, D, Fig. 2, to which the shaft is rigidly attached. To D is attached eccentrically a ring, E, some portion of which is always in contact with the casing, A, and also with the ring, B, at a point exactly opposite, so that the ring is really the piston of the pump, since the whole disk, D, is rotated by the shaft. The equalization of stream is effected by the center ring, B, being deeper than the outside casing, A, so that the cubic contents of annular spaces,

C and L, on inside and outside of the eccentric ring, E, are the same. Bolted to casing, A, and covering, D, is an outer case, F, in a socket in which the shaft end abuts. Holes, G, through portion, D, allow the water to fill the space between D and F, thus balancing the movable portion by equalizing the pressure on both of its sides.

Referring next to Fig. 1, it will be observed that the piston ring, E, is held in the sliding abutment, H. A perspective view of the latter is given in Fig. 3, from which it will be readily understood that the movable tumblers adjust themselves to the eccentric ring, as the revolution of the

ability of the various portions. The pump is further stated to be especially useful for thick liquids, and to be adapted to brewing, tanning, wrecking, and a large number of other purposes. The wear, we are informed, is very slight; and as it takes place on the surfaces in such a manner that abrasion from one compensates for the same on another, the parts always maintain their relative positions.

Patented October 6, 1874, to L. D. Green. For further particulars address the manufacturers, Messrs. Bagley & Sewall, Watertown, N. Y.

Steam as a Fire Extinguisher.

An interesting experiment with Sanderson and Proctor's patent fire extinguisher was recently made in Lower Aspley Old Mill, Huddersfield. The apparatus depends for its effectiveness on the efficiency of steam as a medium for extinguishing fire; and although this is used in many mills, there are some people who doubt its suitability for this purpose. Therefore both points came to the test in the trial. The self-acting arrangement consists of a number of thermometers, which serve as contact makers in an electric circuit, and the apparatus proper, which turns on the steam valve by releasing a pin on the wheel, and permitting the weight attached to the same to turn it round. Contact can be made at any given temperature, the fire simply raising the mercury in the thermometer to the desired point. Lower Aspley Old Mill, which has been used in the woolen trade, is at present empty, and in a condition highly favorable to be burned down from the quantity of oil, grease, and dust deposited on the floors, walls, pillars, and elsewhere. A quantity of firewood and shavings had been placed on the floor of the bottom room, which measures 75 feet x 22 feet x 14 feet high. The fire was lit exactly at half past three, producing immediately a large body of flame, and not quite a minute elapsed before the apparatus turned on the steam. For the next two minutes the fire continued to burn unchecked, but then it became less, and in another two minutes no more flame could be seen. When the steam, which was 40 lbs. in the boiler, had been going into the room for fifteen minutes, it was turned off and the door opened; but a well known crackling inside told that the fire was burning up again, so the door was closed, and steam turned on for twenty minutes longer; this was quite sufficient to remove every trace of fire, and, after the room had been aired for about half

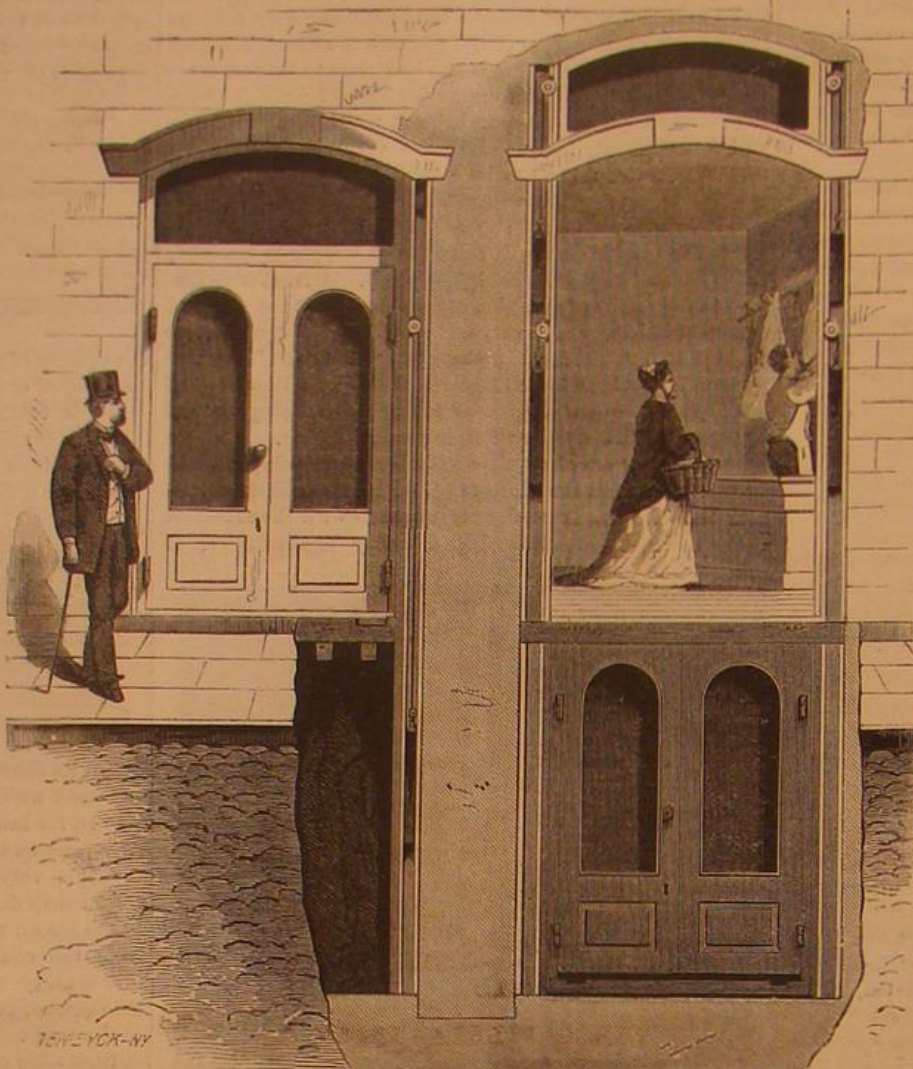
an hour, the whole of the interior was perfectly dry, and no trace of moisture could be detected, a circumstance which may be easily explained, and one of great importance to machinery in rooms where steam has been used as an extinguisher. When we say moisture, we exclude one or two pools of water in a low part of the floor. An artificial wooden floor upon which the fire had been placed was very slightly charred in one place, and the quantity of firewood burned was very small. The trial was so far a success, both as regards the apparatus and the agency of steam as an extinguisher.—*Engineer*.

Sulphur as a Fire Extinguisher.

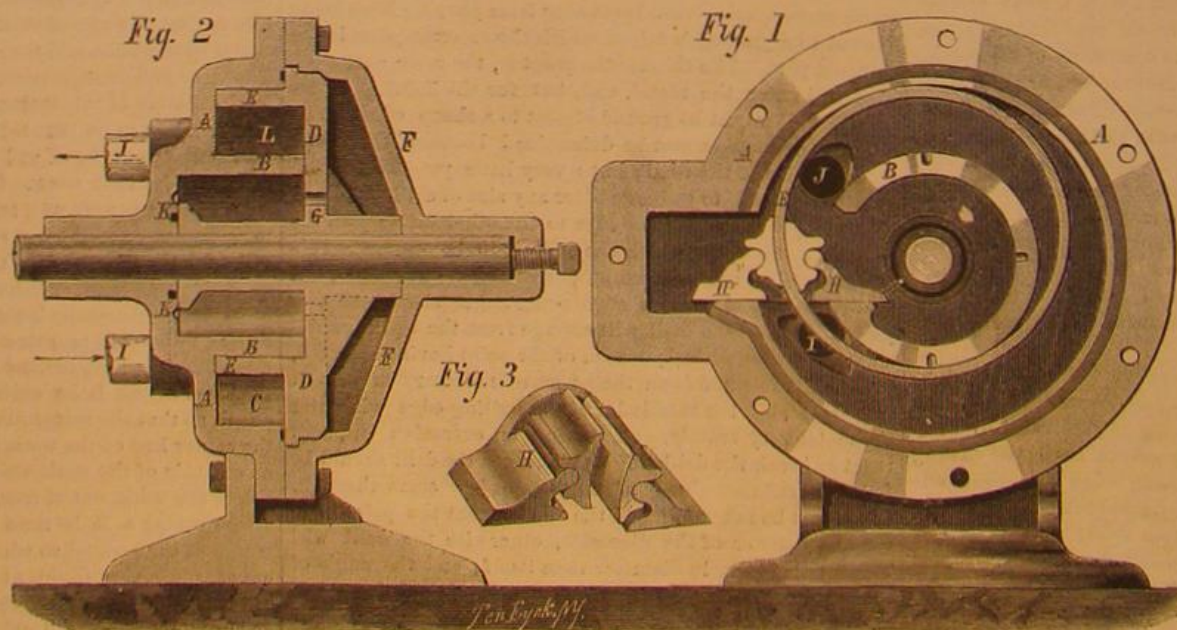
Les Mondes suggests that brimstone should be carried on board every ship for use in case of fire. Half a hundredweight (30 kilos.) of brimstone would be sufficient to abstract the whole of the oxygen from 3,531 cubic feet of air, thus rendering it unfitted to support combustion. In a closed space, like a ship's hold, the sulphurous gas produced by the burning of the brimstone would penetrate where water from the decks could not be brought to bear, and the density of the gas would prevent its rising or spreading if care were taken to close the hatches carefully with wet sails, etc. It is suggested that the brimstone should be made up in the form of large matches, the ends of which could be passed through scuttles prepared for them in the decks or bulkheads in case of need. It is asserted that \$4 or \$5 worth of brimstone would be sufficient to stifle and annihilate all traces of combustion in an air space of 35,000 cubic feet.

New Property of Glycerin.

R. Godefroy, on examining a chemically pure glycerin, found that when heated to 303° Fah. it took fire, and burnt with a steady, blue, non-luminous flame, without diffusing any odor or leaving a residue. The glycerin had the specific gravity 1.2609. This property enables glycerin of lower specific gravity to be burnt by means of a lamp wick.



MURPHY'S MOVABLE FRONTS FOR BUILDINGS.



BAGLEY & SEWALL'S ROTARY PUMP.

space. The shaft, as shown in Fig. 2, abuts in a socket within which its extremity comes in contact with a set screw, by means of which the bearing against the casing at K is brought up to compensate for wear. At this bearing, it is claimed, all leakage is prevented by a circular groove in the seat, which groove, by a channel, communicates with the suction port. Any escape is thus drawn into the last mentioned orifice.

Among the other advantages claimed may be noted simplicity, ready accessibility of parts without necessitating breaking connection with any of the pipes, and interchange-

GROWING ORCHIDS.

The orchids are among the most recent popular claimants for the attention of the florist and the amateur, and there are some varieties which can be raised with very little trouble and expense, as a large proportion of the entire class require but a moderate degree of heat. The species are very numerous, and are found all over the world, this country being, however, but sparingly represented among them. The best known of the American kinds is probably the showy orchid (*orchis spectabilis*, of Linnaeus); this is found from New England to Kentucky, and beautifies the wooded hills in the month of May. The large, round-leaved orchid (*platanthera orbiculata*) spreads its foliage on the ground, and the white orchis (*p. dilatata*) bears a wand-like spike of whitish flowers. Both these kinds are common in our Northern States. Perhaps, however, the most beautiful of our native sorts is the great purple orchis (*p. peramena*, Gray), with its large, showy flowers. It grows freely in moist spots in the West and South.

As a rule, all orchids require plenty of moisture, and the beautiful English specimen shown in our engraving is elevated in a bed surrounded by spars of wood, serving to keep the roots well supplied with air, and to surround them in a water-bearing mass of moss or other vehicle.

New Form of Concrete Foundations.

At Glasgow harbor, the foundations for a 60 ton crane have been put down on a new principle by Mr. Deas, engineer to the Glasgow Harbor and Clyde Navigation.

The quay wall itself is carried on triple groups of 12 feet cylinders. The crane seat rests on twelve concrete cylinders, 2 feet 4 inches thick and 12 feet external diameter, in three rows of four each. The four front cylinders were made in pairs, and the middle and the back rows singly, the last two rows being joined together by tongues of brickwork. The cylinders were made in wooden frames, in rings about 30 inches deep. They are composed of a mixture of five of gravel to one of Portland cement, and were ready to lift and set in position after being made about three weeks.

The cylinders sit each on a cast iron shoe, on which, after being set in the trench, brickwork in cement was built to a height of 5 feet. On the top of this the concrete rings were placed, and jointed together with strong Portland cement mortar. The bottom of the trench in which the shoes were placed close together was about 3 feet above low water level. After the building of the cylinders on the shoes was completed, they were sunk, by means of Milroy's patent excavators, until the bottom of the shoes reached the depth of 32 feet below low water level, or about 52 feet below quay level, about 100 tons of cast iron rings, of the same shape as the concrete rings, being required to force each cylinder down. The cylinders were then cleaned out by the excavators to the level of the bottoms of the shoes, and filled with Portland cement concrete, the lower 9 feet of the front cylinders being composed of five of gravel to one of cement, all the other concrete used in filling being nine to one. The diamond spaces between the cylinders were also cleaned out to the same level, and filled to the top of their cylinders with concrete, five to one.

THE SOLANUM CRINITUM.

This is one of the handsomest of all the plants known as sub-tropical, when grown in warm sheltered spots. According to the *Revue Horticole*, this plant was introduced to Paris gardens in the year 1862, and is a native of Guiana. It is, in addition to its fine size and dignified port, a plant of remarkable beauty, owing to the texture of its leaves, which are covered with a deep rich velvet of tender green color, with violet veinings set with spines. So very remarkable a plant deserves to be cultivated as an indoor plant where the climate will not permit of its being grown out of doors.

Panoramic Photographs.

M. J. F. Plucker, of the Belgian Photographic Association, contributes to the *Bulletin* an ingenious method of producing panoramic prints from two or more negatives. The negative must be taken so as to include, at the edges where the junction is to be made, a portion of the subject in common. This portion is printed from one of the negatives upon a slip of paper, which is divided in the center with a penknife. The two halves are then attached to the negatives in such a manner as to exactly cover the portion it is intended to "stop out" of each, a piece of opaque paper, the size of the negatives used, being also gummed on for the purpose of protecting the sensitive paper, which is not covered by the negative. The first negative is placed in a printing frame large enough to hold the number of negatives intended to be combined, and, after printing, the extremities of the line of junction are carefully marked with a pin point. Negative No. 2 is then introduced and brought into register with the

pin holes. This may be done either by holding the frame up to the light, or by resting it on the edge of a table, a lamp being placed on the floor. Having secured the register, proceed to print in the usual way, repeating the operation for each different negative.

Magnetization of Steel.

The magnetic strata are limited to a certain thickness, which they can never exceed. This limit varies in different steels. It is very great in those which are soft, and diminishes as the proportion of carbon augments and as the temper is harder. For certain bars which the author has studied it is ≈ 0.04 ; but he has specimens where it is below



THE CATTLEYA TRIANÆ.

1-10 m.m. The latter only receive what might be called a superficial magnetic coating, the thickness of which it is not possible to augment by increasing the intensity of the current. But if the depth of the magnetization diminishes along with the magnetic conductivity, the intensity of the magnetism increases. It follows that the quantity of magnetism is subject to two causes of inverse variation—the depth which increases, and the intensity which lessens, as the conductivity increases.—M. J. Jamin.

Everlasting Perdition.

A reward of two hundred and fifty dollars is offered in London, for the best essay of moderate pamphlet size, advocating an address by the House of Commons to the Queen,



SOLANUM CRINITUM.

in favor of the revision of the services of the State Church, so as to exclude the threat of Everlasting Perdition against those of Her Majesty's subjects who do not believe in that doctrine. Essays are to be sent in before May 1st of the present year addressed to Rev. R. Spears, 37 Norfolk street, Strand London.

Uses and Properties of Salicylic Acid.

Salicylic acid is prepared from the oil of wintergreen, the latter obtained from the *gaultheria procumbens*, a trailing plant common all over this country and widely known as the wintergreen, tea berry, partridge berry, and deer berry, by boiling the oil for a few minutes with a solution of caustic potash: in this operation wood spirit is liberated, and on the addition of an acid salicylic acid is precipitated. Thus obtained, the cost of the substance has been high. Although its existence has been familiar to chemists, through its little or no utilization, it, in common with a very large number of other organic compounds, has been but slightly known outside of the laboratories. At the present time, however, there is a prospect of the acid coming into wide general employment through the recent discovery, of M. Kolbe, Professor of Chemistry at the Leipsic University, that it can be fabricated from carbolic acid, which discovery has been already put in practice on a large scale by M. Van Heyden of Dresden.

M. Kolbe has found that, while salicylic acid can be produced from carbolic acid, it, on decomposition by heat, regenerates the latter, and, further, it partakes, in common with carbolic acid, of the power of killing the inferior organisms which determine the phenomena of fermentation and of putrefaction.

Salicylic acid is in fact a powerful antiseptic, and, from its harmlessness and freedom from odor and taste, appears to be more valuable, in a considerable degree, than carbolic acid. Its properties are well shown in the following brief summary of M. Kolbe's experiments: Beer yeast, which, as is well known, determines the alcoholic fermentation of sugar, is totally inert on a solution of glucose to which one one-thousandth part of salicylic acid has been added. Ground mustard, when treated with tepid water, yields a strong piquant odor of mustard, but becomes completely odorless if a small portion of the acid be previously added. The acid also hinders emulsin, or the ferment of sweet almonds, from acting on the amygdalin and transforming it into essence of bitter almonds.

A very small quantity of salicylic acid retards considerably the spontaneous coagulation of milk. A quart of beer containing 15.4 grains of the acid and exposed to the air does not become sour, nor does the least vestige of the cryptogamic vegetation peculiar to spoiled beer show itself. Eggs plunged for one hour in a solution of the acid, and in no manner treated otherwise, were found perfectly fresh after three months' exposure to the atmosphere. Meat powdered over with the substance is prevented from spoiling for weeks. To prepare for use, the meat is merely washed to disengage the acid, as the savor of the latter is very slight and by no means disagreeable. This is a remarkably valuable property, and one which will doubtless find profitable utilization in transporting beef from Texas to the Northern States, or from Australia and South America to Europe.

Dr. Thiersch, of Leipsic, has investigated the uses of salicylic acid as applied to surgical dressings. When placed upon cancerous sores and ulcers in a powdered state, it hinders the putrid odor and produces no inflammatory symptoms. The impregnation of tow dressings and of bandages with the substance is found to be attended with excellent results, though it is curious here to remark that the acid is absorbed and afterwards found in the urine. The application of the acid to treating contagious maladies, such as typhoid and cholera, has as yet not been made the subject of experiment; but now that the properties of the substance have brought it prominently before the scientific world, there is little doubt but that the most extended investigations into them will shortly follow. It is already in use in the surgical wards of Roosevelt Hospital in this city, as a dressing for wounds, ulcers, etc., in the proportion of one drachm to sixty-two and a half fluid ounces of water.

Apparatine.

This is a new substance said to give excellent results when employed for preventing incrustation in boilers, besides being useful where gelatin and gelatin-like substances are required. It was discovered by Mr. H. Gerard. It is a colorless and transparent material obtained by treating starch, fecula, farina, and any other amylaceous substances with a caustic alkali. Hitherto it has been found to be best made with potato starch, treated with a ley of caustic potash or soda, the following being the most suitable proportions, and best method of preparing the apparatine: 15 parts potato starch are put into 75 parts water, and kept in a state of suspension by stirring, when 8 parts potash or soda ley at 26° Baumé are to be added, and the whole thoroughly mixed. In a few seconds the mixture suddenly clears, and forms a thick jelly, which is then beaten up vigorously, and the longer the operation is continued the better the quality of the apparatine. It is in this state a colorless, transparent substance, slightly alkaline to the taste, but devoid of smell, and of a stringy, glue-like consistence. It

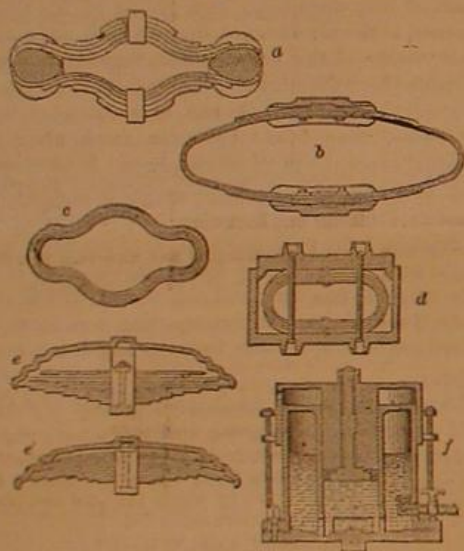
exposed to the air it dries slowly, but without decomposing; and even when heated to dryness, although it thickens and swells, it continues as unchanged as when air dried. When dried in thin sheets it resembles horn, but is more flexible, and may be folded back upon itself without breaking. For sizing textile goods of all kinds, silks, woolsens, cottons, etc., apparatine is said to be admirably adapted, imparting to them a smoothness which hitherto has been found unattainable. When once applied to the goods and become dry, apparatine appears to be virtually insoluble, as three or four washings in hot water have been found to exercise little or no effect upon it, so that it may be used for all purposes in which glue or gum is required. Diaphanous or coarsely woven fabrics, when dressed with apparatine, are rendered stiff and rigid, like a sheet of metal; and the new gum may be used as a thickening in calico printing. It will be understood that we have indicated only a few of the uses of this valuable substance, which, it will be seen, is comparatively cheap. It is necessary to keep it in airtight vessels to prevent it becoming dry, unless it is used up as soon as made, for although it does not dry very rapidly when in bulk, it is not easily rendered soluble when it has once become hard. To prevent incrustation in steam boilers, the apparatine may be placed in the boiler or be added to the feed water in the tank, but the best results have, we believe, been obtained by placing it in the boiler direct.

CAR AND CARRIAGE SPRINGS.

We continue below our series of extracts from Mr. Edward H. Knight's "Mechanical Dictionary,"* selecting for the present paper a variety of interesting engravings relating to the various types of springs in use upon railway cars and on ordinary vehicles.

Car springs may be classed as elliptical, pneumatic, torsional, rubber and steel, rubber, steel, and air, spiral, helical, circular plate (plane, corrugated, and segmental), square plate, and bow. In the engravings which follow, the parts and structures are so evident that only a short description of each will be given. In Fig. 1, *a* is a double elliptic spring, the bearing of the end leaves of which are so shaped that, as

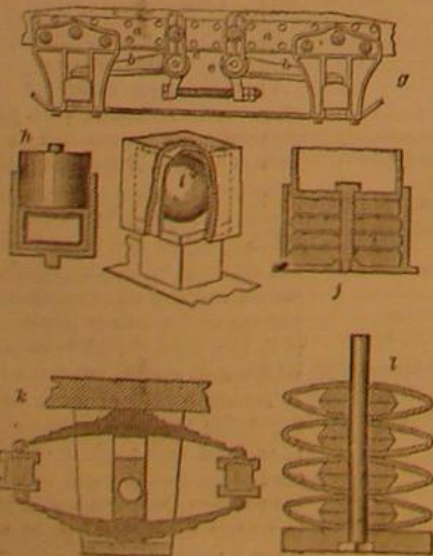
Fig. 1.



Car Springs.

the spring bends beneath its load, additional leaves receive a bearing upon the ovoid bars. *b* is an elliptic spring, the principal leaves of which are made of a continuous plate wound around. Auxiliary plates, above and beneath, extend the area of bearing of the boxes. *c* represents a single plate wound around a mandrel. It is designed to be used with upper and lower bars, as at *b*, or in a box, as at *d*. *d* shows an elliptic spring in a box and a follower above, upon which the weight is imposed. Long bolts secure the follower. *e* is a series of plates which, when under others, assume the form, *e'*. The box above has a series of steps beneath adapted to

Fig. 2.



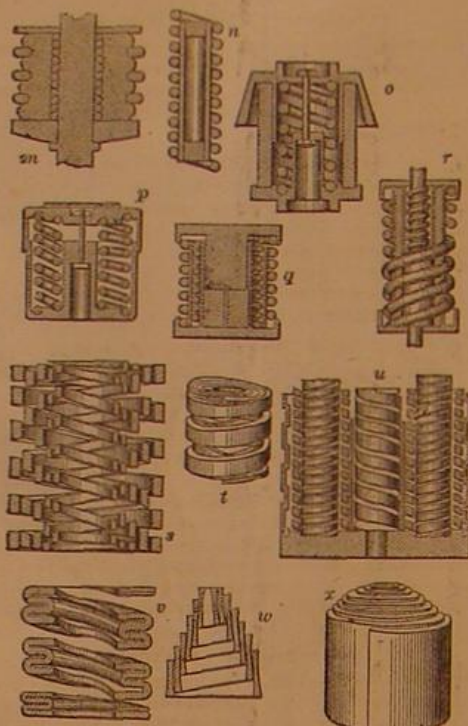
Car Springs.

the lengths of the leaves of the springs, so that, as the weight increases, additional leaves obtain bearings in the box. A form of pneumatic spring is shown at *f*, in which the weight bears upon a box, the central plunger of which bears upon

water, which transfers the pressure to a body of air imprisoned below.

In Fig. 2, *g* is a torsional spring. The weight of the truck comes on spring rods having arms, *b*. The torsional pressure is brought upon the rods, and by them transferred to the axle boxes. *h* is a pneumatic spring consisting simply of a rubber air cushion beneath the box. *i* is a hollow india rubber ball in a box with a polished interior. *j* represents a number of rubber disks in a box beneath a follower. *k* is a combination of steel elliptic springs with auxiliary rubber blocks at the ends. *l* has concavo-convex plates fitted upon a spindle with interposed vulcanized india rubber disks.

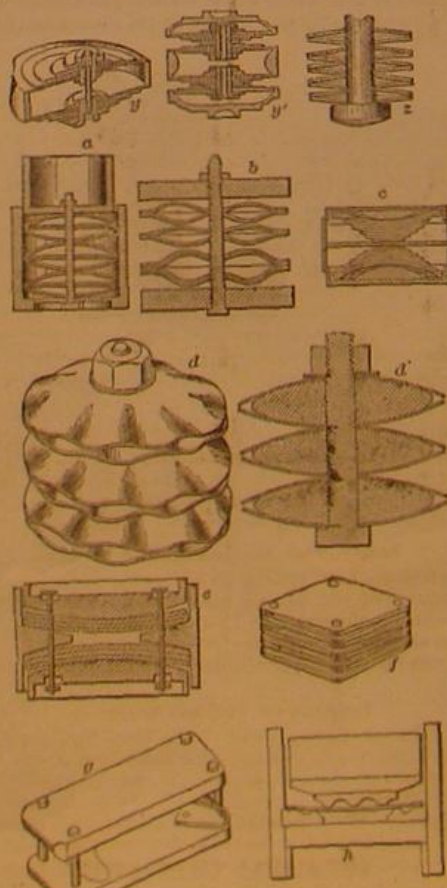
Fig. 3.



Car Springs.

In Fig. 3 a cylinder of vulcanized rubber, with an interior coil to keep it from binding against the spindle, and an exterior spiral coil to keep it from spreading too far, is shown at *m*. In *n* air is inclosed in a rubber tube, which is enveloped in a steel spiral. *o* has an india rubber cylinder inclosing a spiral spring, and a bolt to limit the extent of the upward movement of the cover. The rubber expands into the flanged rim. *p* has a spiral steel spring contained in an annular case. *q* represents a pair of concentric spiral springs on the respective sides of a dividing cylinder. In *r* there is a combination of spiral and rubber springs, with telescopic tubes to form walls. *s* is a concentric arrangement of several spiral springs coiled in alternate directions. *t* shows a closer coil of the same general construction but of different proportions. In *u* each set has a pair of spirals, concentrically arranged, diversely coiled, and inclosed in a cylindrical sheath. *v* is a steel plate folded and then bent into a spiral form around a mandrel. *w* is a volute or helical spring, the inner fold of which, being projected in the line of its axis, is made to sustain the load. *x* is another helical spring shown in elevation.

Fig. 4.



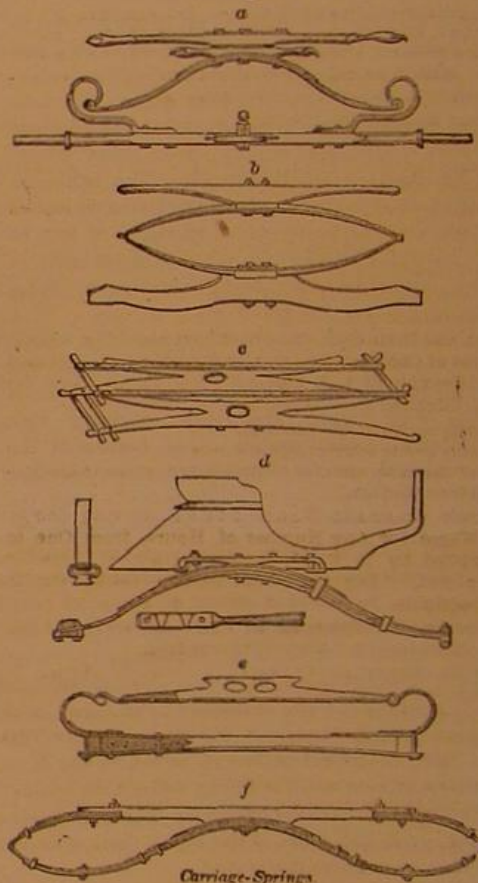
Car Springs.

Fig. 4 represents a variety of springs mainly constructed of plates. *y* and *z'* are views of a set of circular disks of graduated diameters. In *y*, the spring is a pair of such series; in *z'*, two pairs of the same are allied. *z* has annular disks arranged in pairs and united by a rod. *a* has segmen-

tal plates alternating with flat plates in groups, the whole in a box under a follower. In *b* the spring is composed of a pile of circular plates, corrugated radially and arranged round a stem. In *c* the plates gradually increase in length upward and downward from a middle diaphragm. The bearings are on the ends of the longer and outer plates. Rubber springs are placed between the movable top and bottom plates of the case and the spring plates. *d* has several pairs of concavo-convex radially corrugated plates, and between the plates of a pair is a disk of vulcanized rubber. *d'* is a sectional view of the same. In *e*, a box has several metal plates compressed from opposite directions and shortened between bearings as they are bent. *f* has square plates curved diagonally and fastened together at the corners, thus forming alternate pairs, which bear upon each other at the corners and diagonally through the centers; the bearing points of the plates are changed by being lengthened and shortened when the spring vibrates. *g* has square, rhombic, oval, or circular plates bent bow-shaped and placed between bolsters. In *h* the plates are so disposed between the bearing surfaces that, when the weight increases, the load is transferred to points nearer the mid-length, so as to shorten the portion of spring involved in the support.

Numerous modifications and applications of the foregoing examples might be shown, but the above give a sufficiently clear idea of the various devices now in use. While on the subject of springs, however, it will be interesting to note a few of the appliances adapted to carriages, some of which will be found in Fig. 5.

Fig. 5.



Carriage Springs.

At *a* semi-elliptical springs are exhibited, which are hung upon the ends of C springs attached to the axles. In *b* the usual elliptical springs are between the bolster and axle. Elastic wooden springs at *c* connect the axles and also support the bed. At *d* semi-elliptical springs couple the axles. At *e* a bolster is hung upon C springs, and at *f* is shown a system of curved springs, with three points of connection to the bed and two to the axles.

Mr. S. R. Wells.

We notice with much regret the death of Mr. Samuel R. Wells, a well known phrenologist and publisher of this city. Mr. Wells was born in 1820, and was educated as a physician; but subsequently becoming deeply interested in phrenology, he devoted himself thereto, delivering lectures and writing many works on the subject, the principal of the latter entitled the "New Physiognomy." He was associated for some time with Messrs. O. S. and L. N. Fowler. Later, however, he conducted his business alone, and with considerable success.

Mr. Wells was a man of many scientific attainments, a progressive thinker, and a firm advocate of temperance and a proper observance of the laws of health. Works on these topics, by various authors, were frequently issued by him, and the principles of the same strongly maintained in the *Phrenological Journal*, of which he was the publisher and founder. He died on April 18th, after an illness of ten days, and of an attack of pneumonia, followed by other diseases.

A VERY ingenious application of electro-metallurgy has recently been brought before the notice of the Society of Arts. It consists in the application of a coat of silver, by means of electro-deposition, on natural leaves and flowers. By this means very delicate ornaments are produced, since the precise form and texture of the natural leaf is preserved under the thin silver film.

RUBBING warts, night and morning, with a moistened piece of muriate of ammonia, is said to cause their disappearance without pain or a scar resulting.

* Publishers, J. B. Ford & Co., New York city.

Apple Gases.

Bender has experimented with ripe apples and obtained gases from them in the following proportions: 81.07 per cent carbonic acid gas, 18.93 per cent nitrogen gas. He believes that a fermentation is produced at the time of ripening, from which fermentation the carbonic acid gas results.

The way to wash silk is to spread it smoothly upon a clean board, rub white soap upon it, and brush it with a clean hand brush.

NEW BOOKS AND PUBLICATIONS.

A NEW MONETARY SYSTEM, THE ONLY MEANS OF SECURING THE RESPECTIVE RIGHTS OF LABOR AND PROPERTY, AND OF PROTECTING THE PUBLIC FROM FINANCIAL REVISIONS. By Edward Kellogg (from his work on Labor and Capital). Edited by his Daughter, Mary Kellogg Putnam. Fifth Edition. By mail \$1.50, free of postage. Philadelphia, Pa.: Henry Carey Baird & Co., 406 Walnut street.

This book contains many original ideas on the subjects of banking and currency, and gives forth many panaceas for the evils of poverty, hard work, and short pay. We do not think it will convert any one to the belief that the laws of Nature and of supply and demand can be successfully abrogated by special legislation, however specious such law-making may be; but as the production of a sincere and very discursive thinker, the volume demands the attention of students of its subject, which is daily growing in importance to the future of this country.

UNITED STATES HARDWARE AND METAL TRADES' DIRECTORY, comprising a Complete List of the Manufacturers, Importers, Wholesale and Retail Dealers, Commission Merchants, etc., in the United States and Territories. Price \$2.00. Boston, Mass.: Greenough, Jones, & Co.

This book is a most useful compilation, and appears to contain all the information stated in its very comprehensive title. The various trades, including agricultural implement makers, bell founders, boiler makers, engine builders, plumbers, and every other branch of the metal-working business, are arranged alphabetically by States, business headings, towns, and names. Much labor and care have evidently been spent on the work, which appears to be authentic in every particular.

THE METRIC SYSTEM OF WEIGHTS AND MEASURES. By J. Pickering Putnam. New York city: Hurl and Houghton.

Mr. Putnam places the advantages of the decimal or metric system before his readers with much clearness and force; and although the two sides of the question are very generally understood, it is well to keep the subject before the public. If ever the nations adopt any uniform system, there is little doubt that the French plan will be the basis of it; and of this, even the opponents of that system are tolerably well convinced.

WOODEN AND BRICK BUILDINGS, WITH DETAILS, CONTAINING ONE HUNDRED AND SIXTY PLATES OF PLANS, ELEVATIONS, VIEWS, SECTIONS, AND DETAILS OF VARIOUS STRUCTURES. WITH SPECIFICATIONS, FORMS OF CONTRACT, SCHEDULE OF PRICES, ETC. Published Under the Direction of A. J. Bicknell. Volume II. New York city: A. J. Bicknell & Co., Architectural Publishers.

We recently reviewed this handsome work, on the issue of the first volume; and have now to acknowledge the receipt of Volume II, which completes one of the most useful and valuable works on practical architecture ever issued from the press.

WAGGENER'S STANDARD WAGES TABLES, showing Computations of Wages for Any Number of Hours, from One to Sixty. Compiled by D. B. Waggener, Author of "Book-keeping Simplified," "Improved Trial Balance Book," etc. Price \$1. Philadelphia, Pa.: D. B. Waggener & Co.

A complete ready reckoner for all wages calculations, compiled with great care and arranged in a most convenient form.

A SERIES OF AMERICAN CLINICAL LECTURES. Edited by E. C. Seguin, M.D. Volume I, No. 3. Containing "Pneumo-Thorax," by Austin Hunt, Sr., M.D., Professor of Medicine at Bellevue Hospital Medical College. Price 40 cents. New York city: G. P. Putnam's Sons, Fourth avenue and 23d street.

This continued publication is likely to prove of special value to students of medicine, and the various essays are especially intended to be trustworthy guides to practice. Not only are the views of the lecturers given in *extenso*, but the latest authoritative opinions on the therapeutics and pathology of each case are combined in each issue, which is complete in itself.

THE POPULATION OF AN APPLE TREE. By A. S. Packard, Jr., Editor of "The American Naturalist," Author of "Guide to the Study of Insects," etc. Price 25 cents. Boston, Mass.: Estes and Lauriat, 143 Washington street.

A valuable contribution to popular entomological science, deserving to be read by all cultivators of fruit.

THE GLACIAL EPOCH OF OUR GLOBE. By Alexander Braun. Price 25 cents. Boston, Mass.: Estes and Lauriat.

We have here a very readable account of the much vexed question of the glacial theory, which is pointedly written and well illustrated.

SIXTH ANNUAL REPORT OF THE STATE BOARD OF HEALTH OF MASSACHUSETTS. Boston, Mass.: Wright & Potter, 79 Milk street.

THE RESOURCES AND MANUFACTURING CAPACITY OF LOWER FOX RIVER VALLEY, APPLETON, WISCONSIN. By A. J. Reid, Editor of the "Appleton Post." Appleton, Wis.: Reid & Miller.

MISCELLANEOUS ROLLING MILL INFORMATION. No. 10. Pittsburgh, Pa.: J. L. Lewis.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From March 9 to March 29, 1875, inclusive.

AXLE BEARINGS, ETC.—E. D. Murley, New York city.
BORIN WINDER.—M. Cook, Ashfield, Mass., et al.
BOOT TIPS.—E. Mayne, Boston, Mass.
BRAKE, SIGNAL, ETC.—J. Y. Smith (of Pittsburgh, Pa.), London, England.
BUTTON NEEDLE, ETC.—G. Norwood, Boston, Mass.
BUTTER TUB.—C. B. Sheldon, New York city.
COFFEE PULPING MACHINE.—W. V. V. Lidgerwood, Morristown, N. J.
FORMING PULP INTO BOXES, ETC.—S. Wheeler et al., Albany, N. Y.
GAS BURNER.—J. Ellis, Lynn, Mass.
GRINDING MACHINERY.—C. Van Hagen, Philadelphia, Pa.
HONEY SAVING MACHINE.—W. Pearson, Philadelphia, Pa.
INSECTOR.—S. Rue, Philadelphia, Pa.
MOTOR.—J. M. Cayce, Franklin, Tenn.
MUSIC BY ELECTRICITY.—E. Gray, Chicago, Ill.
PAPER BOX MACHINE.—P. B. Machine Co., Cleveland, Ohio.
PHOTOGRAPHIC PLATE.—H. Hill et al., Worcester, Mass.
RAILWAY WHEEL.—R. N. Allen, Hudson, N. Y., et al.
ROLLER SKATE.—G. Pettitt, Oakland Point, Cal.
ROTARY ENGINE.—W. V. V. Lidgerwood, Morristown, N. J.
SCREW GEAR AND STEERING APPARATUS.—D. N. B. Coffin, Newton, Mass.
SCREW MACHINERY.—C. M. Spencer, Hartford, Conn.
SOAP.—S. S. Lewis (of Boston, Mass.), et al., London, England.
SPINNING HEMP, ETC.—J. Good, Williamsburgh, N. Y.
STEAM ENGINE, ETC.—G. B. Dixon, Mass.
STOCKING SUPPORTER.—A. H. Crump, New York city.
TELEGRAPH.—M. Gally, Rochester, N. Y.
UMBRELLA.—U. G. Steinmetz, Philadelphia, Pa.
WEFT STOP MOTION.—T. Isherwood, Westbury, N. I.
WOOD PLANE.—D. L. Toppas, Somerville, Mass., et al.

Recent American and Foreign Patents.

Improved Bucket Bar.

James D. Field, Blue Rapids, Kan.—This bucket bar is constructed of a continuous piece of sheet metal, which is folded with a central rib, that is perforated for the bail, the side plates being attached to the bucket.

Improved Machine for Shearing Metal.

John Walsh and James Dutot, Newton, Iowa.—This device is so constructed that, by a down pressure, the lever will exert a constantly increasing force upon the jaw, and act upon the principle of the knuckle joint. The lower jaw hangs loosely on the fulcrum pin, with the outer end resting on a wedge. This wedge is moved back and forth, to open and close the shears, and act only on the lower jaw.

Improved Wagon Brake.

Lewis B. Morgan, West Liberty, W. Va.—The invention relates to that class of automatic wagon brakes wherein the weight applies the brakes through a sliding reach, and consists in combining with the ordinary brake lever an axle end-slotted reach with an end eye, a rod, lever, and are rod.

Improved Car Coupling.

Charles Hobzner, Louisville, Ky.—The invention relates to that class of car couplings in which no pin or link is used but a pivoted hook, that passes over a shoulder of the opposite car, and couples automatically. The invention consists in a lever upheld at its rear by a spring support, a push bar having a crosspiece supported by springs, and in a peculiar device by which the cars may, with great facility, be uncoupled from the car or from either side.

Improved Bedstead Fastening.

Louis Guenot, Baltimore, Md.—The object of this invention is to provide a fastening for bedstead rails and all kinds of frame work which are to be detachably connected. It consists in a short bolt having at one end a screw thread and nut, and at a squared end to receive a wrench, and at the other a right angular groove. Said bolt is placed longitudinally in one portion of the frame, and is held therein by the said nut, which engages with the side of a recess, the grooved end of the bolt entering a detachable plate in the other portion of the frame work, which is provided with a lug or extension which moves in the said groove, and, when the bolt is turned, draws and locks the two portions of the frame securely together, the nut serving to tighten the devices as they may from time to time require it.

Improved Plow.

B. S. Benson, Baltimore, Md.—The invention consists in combining with a plow a set of wheels placed at an inclination to a vertical plane and provided with a groove upon their peripheries, which receives and runs upon the projecting edge of the unplowed ground.

Improved Ash Sifter.

Frederic Anthes, New York city, assignor to Theodore Wenk and Samuel Leber, of same place.—The invention relates to connecting the sections composing the body of the sifter to the circular ends thereof by means of slotted lugs and clamping bolts, also to the construction whereby the removable door section of the sifter is attached and held in place. By this construction the various parts of the sifting cylinder can be very easily and quickly put together and taken apart, and the sifter can be cheaply made.

Improved Spring Bed Bottom.

Edward P. Bennett, Elkland, Pa.—The present invention relates to new and useful improvements in spring bed bottoms, and consists in springs attached to the head and foot boards, having eyes which hold rods, and in a series of solid spring slats, slotted at the ends to receive the rods, the said rods being divided or split, and having central springs.

Improved Neck Tie.

Alden J. Adams, New York city.—The object of this invention is to prevent the slide of a cravat from slipping down while the said cravat is being worn. It consists in the combination of a flap, provided with a hook and eye or other fastening with the body of the slide.

Improved Wardrobe Bedstead.

Robert G. McClure, Jamestown, O.—This consists of straps for the purpose of holding the bed, and preventing it from bulging when turned up, the same being stiffened in the middle, while their ends remain flexible, and are provided with loops that fasten over knobs on the side boards of the bed bottom.

Improved Cloth-Shearing Machine.

Isaac L. Holmes, Saco, Me.—The first part of this invention consists of an automatic feed-regulating apparatus, whereby the cloth is delivered to the machine, so that it has a uniform tension while passing through it, not subject to the unequal pulls and strains common to the cloth when drawing into the machine. The second part consists of an automatic contrivance, whereby the revolving cutters are stopped by a seam when it approaches them, and allowed to rest until the seam passes, and then set in motion again, as it passes away from them, to protect the cutters from the effects of the extra thickness of the seam, and to prevent the seam from being cut. The third part of the invention consists of the bed pieces of the stationary knives pivoted to the frame, so that these knives can be readily swung up away from the revolving knives to facilitate the cleaning of the latter of the oil and emery used in sharpening them.

Improved Casting of Steel-Faced Anvils.

John Donovan, Carpentersville, Ill.—This consists in a wire loop in the bono of the plate, for keeping it in place in the mold, and in constructing the face plate concave on the side receiving the iron, to compensate for the greater shrinkage of the iron in the middle.

Improved Railroad-Car Truck.

Alonso Gilman, Lewiston, Idaho Ter.—This invention consists of the application of one double flanged wheel and one plain or flange wheel to the same axle of a railroad car truck. It also consists in an alternate arrangement of these wheels on adjacent axles so that both rails are utilized, and the cars are kept properly on the rails.

Improved Barrel Barrow.

James Harding Brown, Porter's Mills, Wis.—This is an improved barrow for carrying barrels and other things, which may be used as a wheel barrow or as a hand barrow. It may be expanded or contracted to adjust it for carrying a larger or a smaller barrel, as may be required, and the side bars and braces locked in place when adjusted. The said wheel can be conveniently attached and detached, as required, and the side bars and braces locked in place when adjusted.

Improved Car Axle Lubricator.

John D. Emboden, Richmond, Va.—The invention consists in a detachable wire frame, having elastic sides that press a woven fabric or other absorbent to each side of the journal, thus supplying the lubricant and wiping the journal at the same time. The great merit consists in the facility with which it may be applied to any journal box and removed therefrom.

Improved Paper Dryer.

Jonathan Hatch and Guilford Smith, Windham, Conn., assignors to Smith, Winchester & Co., same place.—Each side is provided with girders, which support the cylinders and fans. These cylinders each have two heads, which consist of a hub and a spider, each being made separately and fastened together. The advantages claimed in this manner of making these heads are, first, to prevent breakage in the shrinkage in casting; secondly, to admit of lightening the several parts; thirdly, to facilitate the construction of said heads and hubs. The longitudinal rails, which connect the cylinder heads, are stayed by internal rings. Wire is wound spirally over the cylinders and fastened with a cap piece. These cylinders are revolved in a steady and uniform manner, gear wheels being attached to the hubs at one end, which engage with each other.

Improved Cotton Chopper.

Theodore C. Burnham, Waco, Tex.—The chopper knives are attached to rods which project rearward and inward, so that their inner ends may meet or slightly overlap at an angle. By operating an arm, the knives may be held back and prevented from cutting, when desired. A spring is made of such a strength as to hold the knives to their work under ordinary circumstances; but should said knives strike anything they cannot cut, the spring will yield and allow the knives to swing back and pass the obstruction.

Improved Bird Food Holder.

Samuel E. Tompkins, Sing Sing, N. Y.—This is a gripping tongs for holding sugar lumps, bread, cuttle bone, pieces of fruit, and the like, with a gripping stand or foot adapted for temporarily attaching it to the wires of the cage, so as to hold the food permanently.

Improved Distance-Measuring Instrument.

William F. Harris, Chicago, Ill.—The invention consists of two reflectors, of which one is placed stationary on a suitable frame under an angle of forty-five degrees, in front of the object glass of the telescope, extending to the height of the center line of the same. The other pivoted reflector is mounted on a sliding piece, which moves under suitable angle to the line of sight along a scale on which the distance is indicated by a pointer of the pivoted reflector at the point where the reflected picture and the real object, seen by the upper half of the telescope above the stationary reflector, fall exactly into one.

Improved Harvester.

Charles D. Shrader, Lancaster, Wis., assignor to himself and Allen R. Bushnell, same place.—This is an attachment for the platforms of grain harvesters, for the purpose of facilitating the work of the binders. It consists in a sweep operated to compress the gavel against the rear side of the platform.

Improved Mangle.

Henry Tamme, Bartlett, Ill.—This consists in a weighted pressure box, with central shafts, which is connected by slotted and fulcrum levers and connecting rods with crank wheels, operated by an intermeshing cog wheel, for imparting reciprocating motion to the press box by the continuous rotation of a hand crank wheel, so that one person may readily work the mangle and tilt the weighted box, while another feeds the clothes rollers to the same.

Improved Game Board.

Owen A. Gill, New York city.—This invention consists of a disk, which is balanced on a central bottom handle, and provided with indentations or cup-shaped recesses and different obstructions for rendering the playing of a ball thrown from a revolving wheel into these holes more difficult and hazardous.

Improved Cording Attachment for Sewing Machines.

Hamilton C. Jones, Brooklyn, N. Y.—The lower part of the presser foot is provided at one side with a beveled recess, which guides the cords on a level with the foot without the cords being acted upon by the presser foot, and impeding the regular stitching to the fabric. A sheet metal guide plate slides in grooved guides at the top of the presser foot, and may be laterally adjusted thereon, to be locked and retained for guiding any thickness of cord to the needle by a spring arm with a hook edge snapping into grooves of the presser foot. The side flange of the guide plate is provided with a folding front extension, which is bent in the shape of a flat tapering tube, by which the cord and fabric are gradually folded, and thereby more easily fed.

Improved Car Wheel.

Samuel Baldwin Chapman, New York city.—The wooden tread is made by gluing together pieces of veneering placed obliquely to each other and obliquely to the wheel, so that the exterior surface of the sections which form the tread will be endwise of the grain, and then turned off outside and in. This tread is made in two sections, having between the sections a steel ring, which will resist the wear while affording a much greater degree of traction than can be obtained from an entire metallic tread. A metallic band surrounds a heavy rubber ring which surrounds the hub. The rubber ring acts as a cushion to give the wheel flexibility, and to relieve the rolling stock of concussions.

Improved Millstone Dress.

Jefferson Carvill and John Caven, Kingston, Minn.—The middle portion is arranged about an eighth of an inch lower than the face, but rising in concave shape up to the level of the inner margin of the face. This recess may, of course, be dressed out from time to time, as the stone wears away; but in order to save the labor of so dressing it, it is proposed to construct the part separate from the other, and arrange it in a recess, with adjusting screws to lower it away from time to time, as the face of the stone wears.

Improved Travelling Cap.

Adolph Schwarz, New York city.—This consists in the introduction of a connecting piece across the opening for the face, by which the eyes and mouth are left uncovered, but the nose and cheeks protected.

Improved Device for Moving Railroad Cars.

Benjamin F. Phelps, Kansas City, Mo.—The object of this invention is to provide means for moving cars on railroads; and it consists in a lever slotted at the lower end, having a friction wheel in the slot and a crab pivoted to its end. It also has a removable fulcrum composed of two bars attached to its side, to the lower ends of which fulcrum bars a self-adjusting crab is attached.

Improved Sewing Machine Shuttle.

John G. Nichols, New Eureka, Kan.—This invention consists in a sewing machine shuttle which is so constructed that a perfect tension of the thread is obtained by a tension device, occupying but little space, within the shuttle body, the threading operation being also performed with greater ease and celerity than in the shuttles heretofore constructed, by dispensing with guide eyes, and using, instead, notches and slots into which the thread can be readily entered.

Improved Can for Mixing Paint.

Walter W. Thayer, New York city.—This invention consists of a can with a hollow handle, forming a receptacle for the mixing liquid. The handle communicates by a vent hole and guiding orifice, which are closed and opened by a hinged spring valve, with the mixing can for admitting the required quantity of liquid to the color. The marking brush is placed after use into a side sleeve of the handle and recess of the can, while the paper with the direction to be marked is secured by a spring holder to the can.

Business and Personal.

The Charge for Insertion under this head is \$1 a Line.

Agricultural Implements, Farm Machinery, Seeds, Fertilizers. R. B. Allen & Co., 189 & 191 Water St., N. Y.
Magic Lanterns, Stereoscopes of all sizes and prices, for Parlor Entertainment and Public Exhibitions. Pays well on small investment. Catalogues free. McAllister, Man'g. Optician, 49 Nassau St., N. Y.

Fleetwood Scroll Saw, with Boring Attachment, for all descriptions of light Scroll Sawing. See adv't. page 285. Trump Bros., Manufacturers, Wilmington, Del.

The Worcester (Mass.) Gazette says: "They who wish to advertise judiciously and cheaply can find no better medium through which to reach the great public than through Geo. P. Rowell & Co's Agency, New York."

Tinners, all—Address No. 8, Marcellus, Mich.

2nd Hand Engines and Boilers for Sale at Low Prices. Address Janus Harris, Titusville, Pa.

Hand Bolt Cutters, Power Bolt Cutters, Lightning Screw Plates, etc. Wiley & Russell Manufacturing Company, Greenfield, Mass.

Telegraph and Electrical Instruments and Batteries, cheap. M. A. Buell, 86 Bank St., Cleveland, O.

1,000 lbs. English Steel Needle Wire, in coil, No. 14 Iron Wire Gauge, for sale less than cost of importation; also, 500 lbs. of No. 16, suitable for needles, spiral springs, or any purpose requiring a fine quality of steel. Goodnow & Wightman, 23 Cornhill, Boston, Mass.

The "Lehigh" Emery Wheel. A new patent. Address Lehigh Valley Emery Wheel Co., Weymouth, Pa.

1, 2 & 3 H.P. Engines. Geo. F. Shedd, Waltham, Ms.

Small Property, well located for economical manufacturing. Lump coal costs \$2, and Nut coal \$1.50 per ton, delivered. Taxation 1.37. Employees' houses rent for \$5 to \$12 per month. Excellent shipping facilities. Buildings new and in good repair. Good schools, churches, and desirable community for residence. Full description, price and terms, by addressing Kittredge Cornice and Ornament Company, Salem, Ohio.

For Sale—Small Engine and Boiler. "G. L. W.," Steubenville, Ohio.

We have a light Machine (Gray and Malleable Iron and Steel) which we want to have manufactured. Will contract for 1,000 and upwards. Address Bartlett & Co., Quincy, Ill.

For best and cheapest Surface Planers and Universal Wood Workers, address Bentei, Margedant & Co., Hamilton, Ohio.

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

Models for Inventors.—H. B. Morris, Ithaca, N. Y.
Wanted—Foreman in an Agricultural Machine Shop. Reference required. Address Harris Manufacturing Company, Janesville, Wis.

A Rich Gold Mine Discovered for Agents Selling very desirable New Patent Articles for housekeepers and others. G. J. Capewell, Cheshire, Conn.

Every Metal Worker should have a Universal Hand Planer. Address J. E. Sutterlin, 80 Duane St., New York.
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. T. Holland, 57 Gold St., New York.

Diamonds and Carbon turned and shaped for Scientific purposes; also, Glaziers' Diamonds manufactured and reset by J. Dickinson, 64 Nassau Street, N. Y.
See N. F. Burnham's Turbine Water Wheel advertisement, next week, on page 301.

For Sale—A new patent for a Cross-Cutting Machine, the best in the market. Can be seen in operation 124 Goerck St., New York. Inquire for Geo. Marshall.

Soap Stone Packing in large or small quantities. Walrus Leather Wheels for polishing any Metals. Belt Studs for fastening Leather or Rubber Belts. Baxter Wrenches for difficult corners. Greene, Tweed & Co., 15 Park Place, New York.

Three Second Hand Norris Locomotives, 16 tons each; 4 ft. 3½ inches gauge, for sale by N. O. & C. R. B. Co., New Orleans, La.

For Sale—Factory. Two Stories, 36x80—Engine and Boiler, 40 horse power—Shafting, Steam Dry House, Sheds, etc. Lot, 34x220 ft. Good chance for manufacture of cheap furniture or agricultural implements. Hardwood lumber in abundance and cheap. Address, for particulars, Sayer & Co., Meadville, Pa.

Agents—100 men wanted; \$10 daily, or salary—selling our new goods. Novelty Co., 300 Broadway, N. Y.

Thomas's Fluid Tannate of Soda never fails to remove Scale from any Steam boiler; it removes the scale-producing material from all kinds of water; cannot injure Boiler, as it has no effect on iron; saves 20 times its cost both in Fuel and repairs of Boiler; increases steaming capacity of Boiler; has been tested in hundreds of Boilers; has removed Bushels of Scales in single cases. It is in Barrels 500 lb., ¼ Bbls. 250 lb., ½ Bbls. 125 lb. Price 10 cents per lb., less than ¼ price of other preparations, and superior to all others. Address orders to N. Spencer Thomas, Elmira, N. Y.

For Tri-nitro-glycerin, Mica Blasting Powder, Electric Batteries, Electric Fuses, Explosives, Gutta Percha Insulated Leading Wires, etc., etc., result of seven years' experience at Hoosac Tunnel, address Geo. M. Mowbray, North Adams, Mass.

Faught's Patent Round Braided Belting—The Best thing out—Manufactured only by C. W. Army, 301 & 303 Cherry St., Philadelphia, Pa. Send for Circular.

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.

The Lester Oil Co., 123 Water St., N. Y., Exclusive Manufacturers of the renowned Synovial Lubricating Oil. The most perfect and economical lubricant in existence. Send for Circular.

Wash Stands, New Styles, Marble Tops, can be used in any situation. Prices very low. Send for catalogue. Bailey, Farrell & Co., Pittsburgh, Pa.

Send for Circular of a very Superior Boiler Feed Pump. D. Frisbie & Co., New Haven, Conn.

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

Mechanical Expert in Patent Cases. T. D. Stetson, 25 Murray St., New York.

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

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing Metals. E. Lyon, 420 Grand Street New York.

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

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, twellings. Works for any distance. Price \$6, with good Battery. F. C. Beach & Co., 246 Canal St., New York, Makers. Send for free illustrated Catalogue.

Small Tools and Gear Wheels for Models. List free. Goodnow & Wightman, 23 Cornhill, Boston, Mass.

Hotchkiss Air Spring Forge Hammer, best in the market. Prices low. D. Frisbie & Co., New Haven, Ct. Genuine Concord Axes—Brown, Fisherville, N. H. Temples and Olicans. Draper, Hopedale, Mass.

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

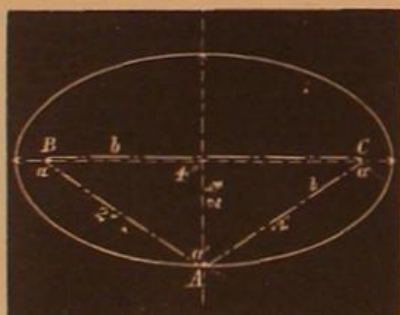
Spinning Rings of a Superior Quality—Whitinsville Spinning Ring Co., Whitinsville, Mass.

All Fruit-can Tools, Ferracute W. K's, Bridgton, N. Y.

Notes & Queries

F. O. B. should consult a physician.—R. J. W. will find directions for gilding on furniture on p. 347, vol. 31.—S. A. T. will find directions for frosting glass on p. 264, vol. 30. Canvas can be preserved from mildew by the method described on p. 90, vol. 31. A black dressing for leather is described on p. 171, vol. 32.—W. S. O. will find a recipe for walnut stain on p. 90, vol. 32. Nickel plating is fully detailed on p. 171, vol. 30.—C. A. H. will find that a method of casting iron free from air-holes was described on p. 409, vol. 31.—Y. will find directions for making concrete gravel walks on p. 50, vol. 32.—A. B. M. will find that the induction coil and its operation have been fully described on p. 382, vol. 31.—E. B. M. will find a description of the type writer on p. 78, vol. 27. Shaving soap is described on p. 251, vol. 32. For gold ink, see p. 21, vol. 26.—W. M. W. will find recipes for hair wash on pp. 267, 383, vol. 31.—T. B. S. will find directions for preserving natural flowers on p. 206, vol. 31. M. T. D. will find directions for removing hair from the face on p. 229, vol. 28.—S. E. will find directions for casehardening iron on p. 69, vol. 31.—D. P. will find details of a remedy for foul water in wells on p. 59, vol. 32.—M. F. will find recipes for Worcestershire sauce on pp. 241, 281, vol. 26.—R. O. B. can mold rubber by following the directions on p. 363, vol. 30.

(1) G. A. W. says: I noticed in your issue of March 27 a method for marking out ovals, which is good as far as the description goes, but a great many mechanics do not know how to set the two pins to put the string around to make the oval of a given length and width. The following rule will be found simple and correct: If you wish to mark out an oval 4 inches in length, and 2½ inches in width, mark out the length and width thus:



Take one half the length (2 inches) and measure from A, 2 inches, striking the line of the length at B and C; then set pins at A, B, and C, tie your string, b, around them; then pull up pins at a', and use the pencil as you describe.

(2) L. A. W. asks: 1. What is magnetism? A. Magnetism is the power which certain bodies called magnets have to attract iron. Magnets are of two kinds, natural and artificial. Natural magnets consist of the ore of iron called magnetic or lodestone. Artificial magnets are made generally of steel, and are magnetized by rubbing against other magnets. No substance is indifferent to the magnet, though iron is most of all affected by it. 2. What is the difference between animal magnetism and electricity? A. There is no known connection between animal magnetism and electricity. If any exists, it has yet to be proved.

(3) I. H. asks: 1. How can I obtain the different colors of gold in electroplating? A. Make a mixture composed of 3 parts nitrate of potash, ½ alum, ½ sulphate of zinc, ½ common salt. Add enough water to form a paste, which is put on the articles to be colored. Place them on an iron plate over a clear fire until they attain a nearly black heat, and then plunge them in cold water. Different hues may be had by varying the mixture. 2. Is there anything I can put in my silver solution that will prevent it from stripping? A. Clean the articles well and electroplate them slowly; and then the silver will not strip off.

(4) M. A. G. asks: Is there any kind of lamp in which I can burn kerosene oil, that will be safe if left to burn in a shop all night? A. Use a large lamp of glass, having a proportionally small burner, and good kerosene oil, and you will have no difficulty.

(5) A. H. H. asks: 1. What is the principle of the lightning arresters used on telegraph lines? A. A metallic plate is connected to the line and another to the earth, the two plates being separated by a thin insulating material. The principle upon which the arresters works is that the tension of the atmospheric electricity is so high that it will leap across the insulating substance between the two plates, and then pass off to the ground, while the regular current will stick to the wire. 2. Can you give your readers a table showing the electro-

motive force of the principal forms of battery now in use on telegraph lines? A. The electromotive forces of the various batteries are as follows: Daniells, Minotti's, Callaud's, Glantz's, and Hill's, 1.079 volts; Marie-Davy, 1.324 volts; Léclanché, 1.48 volts; Faure's carbon battery, 1.765; Grove, 1.812; Bunsen, 1.964; electropoin fluid (bichromate of potash), 2.028 volts. Grenet (chromate of potash) single element, 1.015 volts.

(6) M. W. M. asks: How can I magnetize a steel tack hammer? A. Draw it across the face of a strong electro-magnet in one direction.

(7) N. A. B. asks: How many methods are there of obtaining pure silver from silver coin, and what are they? I want the silver to plate with. A. Perhaps the best method for operations of this character on a small scale is the following: First dissolve your coins in nitric acid, and add muriatic until no further precipitate forms. Remove the liquid by filtration and wash the precipitate several times with hot water. Place the filtrate in a flask with some small pieces of zinc, and cover them with dilute sulphuric acid (1 to 4). When the zinc is completely dissolved, the metallic silver will be found in the bottom of the flask as a grayish black mass. The color is due to the fact of the silver being in a very finely divided condition. If you desire to use the silver in the metallic form (as an anode), all that is necessary is to melt it in a small black lead crucible, with a small amount of carbonate of soda.

(8) E. asks: What makes the wet end of a towel darker in color than the dry end? A. Less of the light is reflected from the wet towel, and more transmitted.

(9) G. W. H. asks: Are there any chemicals that change color in coming in contact with magnetized steel or other magnetized substance? A. We do not know of any.

(10) T. says: The accepted theory is that our earth was once a molten, incandescent mass. In support of this theory, among other phenomena, it is urged that the deeper the earth's crust is penetrated, vertically, the greater the degree of heat is developed. Now why is it that the further we penetrate the ocean, the less is the degree of heat attained? Will it be urged that the lower the temperature of water, the greater is its gravity? This is true down to 39°, but water at the bottom of the ocean, at the extreme depths that have been reached, shows a lower temperature than 39° Fah. A. What is urged is no objection to the theory of central heat, because the heat penetrates by conduction through the materials of the solid crust. But in the waters of the ocean this could not take place, owing to the free motion of its particles.

(11) E. E. M. asks: 1. Can an electro-magnet be constructed that will sustain a weight of 100 lbs., with one cell of a powerful bichromate battery? A. Yes. 2. How far will it attract a weight of 10 lbs. if it moved without friction? A. The attraction decreases as the square of the distance.

(12) D. McK. says: I want to make a small galvanic battery which, when I take hold of the wire, will give a considerable shock? What is the best method? A. You cannot get a considerable shock from a small battery except by passing the current through an induction coil. See p. 362, vol. 31.

(13) T. W. D. asks: 1. How is phosphide of lime made? A. Phosphide of calcium, commonly known as phosphide of lime, is obtained by the action of the vapor of phosphorus upon caustic lime at a high temperature.

1. How is balloon gas made? A. Either pure hydrogen, made by acting upon zinc or iron scrap with dilute sulphuric acid, or common illuminating gas (coal gas) is used for this purpose. 2. Will the gas from a kerosene lamp do? A. No. 3. How many square feet of gas will it take to raise a five lb. balloon? A. It will require about 140 cubic feet of coal gas, or about one half that volume of pure hydrogen.

How is gunpowder made? A. Saltpeter, sulphur, and charcoal are ground separately to powder, mixed, made into a paste with water, dried, and reground.

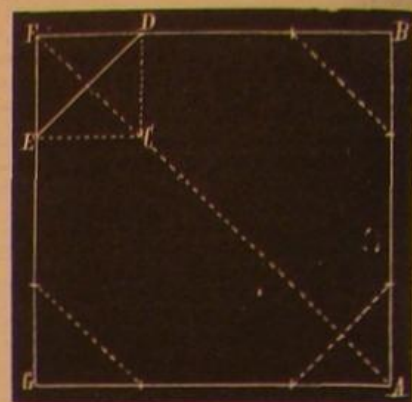
(14) H. S. asks: Would it improve the illuminating qualities of coal oil to mix a portion of sperm, lard, or other similar fixed oil with it? A. No. Use a better kerosene. It should not be volatile, and should have a high burning point.

(15) A. C. C. asks: Will you tell me what to put on glass so that I can take a photograph directly on it? A. The plate is first coated with an even film of photographic collodion, and is then placed in a bath of nitrate of silver for a short time. It is then transferred to the camera, and after exposure is washed, first with a solution of sulphate of iron, and then with a solution of hyposulphite of soda. It may be mentioned that it is utterly useless for one to attempt photography who has not devoted some time to the practical study of it. We would refer you to some work on the subject. If the back of the negative, obtained by the method as above described, be blackened, it will give to the plate, when looked at, the appearance of a positive picture.

(16) J. R. L. says: I want to make a preparation to use on black tobacco to prevent one lump from sticking to the other, and at the same time give the tobacco a good gloss. A. Try plumbago. Tinfoil cannot be dissolved so as to make it possible to add it to a mixture of oil and glycerin.

(17) C. G. D. says: I am manufacturing black writing ink from extract of logwood, bichromate of potash, prussiate of potash, powdered gum arabic, and water. After the ink is first bottled, there is a scum formed at the mouth of the bottle; but when this is removed there is no more formed. What is the cause of this? A. It is probably due to impurities in the materials used. Allow the ink to stand some time before bottling. Sulphate of quinine is sometimes used as a remedy.

(18) G. A. W. says: I have read the following directions for drawing an octagon in a given square: Make A C equal A B; then draw the square



C E F D, and line from D to E will be one side of the octagon. Proceed in the same manner in the other angles of the square A B F G. Is this a correct method? A. Yes.

(19) F. D. S. asks: Is there any chemical which I can mix with lard oil so as to retard or prevent oxidation when exposed to the air? A. No.

(20) P. S. G. asks: Is there any kind of coating suitable for umbrellas that will make the alpaca or gingham tops waterproof? A. Try the following: First sponge the cloth on both sides with a solution of 1 part sulphate of alumina in 10 parts water, then with a solution of soap, which is prepared by boiling 1 part light colored resin and one of crystallized carbonate of soda with 10 parts water, until the resin is dissolved. The resin soap thus formed is to be separated by the addition of common salt. This soap is then dissolved together with 1 part soda soap, by boiling in 30 parts water. After this last sponging, rinse in the rain.

(21) P. P. W. asks: How can I take the printed heads off an account book, so as to be able to write others in their stead? A. We do not know of any method by which this can be accomplished.

(22) J. G. C. asks: Is there any simple method by which an amateur in chemistry may ascertain the strength of a given sample of native black oxide of manganese? A. The commercial value of black oxide of manganese depends upon the proportion of chlorine which a given weight of it will liberate when it is heated with hydrochloric acid. This quantity of chlorine varies much in different samples, and is dependent upon the proportion of oxygen which the oxide of manganese contains in excess of that which is necessary to its existence as protoxide.

(23) J. E. C. asks: 1. Is there a liquid that will erase ink marks from paper, and leave the surface in a smooth state? A. Wash by means of camel's hair pencils, dipped alternately in solutions of cyanide of potassium and oxalic acid. 2. Is there any substance that will resist the action of mucilage when dry, except hard and vulcanized rubber? A. Yes. Most metals will do this.

(24) S. H. D. says: Located near Titusville, Pa., is an immense gas well, struck nearly 4 years ago by parties who were drilling for oil. When first struck, it was accompanied by a curious phenomena. The gas was led away from the mouth of the well by 4 pieces of tubing, and this tubing was coated with ice from ½ to ¾ of an inch in thickness. This was with an August sun beating down on the pipes; small pieces of ice were also thrown out of the well with considerable force. Of course the pressure on the pipes must have been very great with such an immense volume of gas passing through them, and I should have thought the friction would have caused heat instead of the reverse. A. It is a well known fact that when a gas is allowed to escape from where it has been under pressure, it absorbs heat rapidly from surrounding bodies, and that this chilling effect is proportional to the pressure from which the gas is liberated.

(25) A. S. asks: How can I restore the polish to a nickel-plated stove which has been discolored by heat? A. Use chalk and chamois skin.

(26) C. A. B. asks: 1. What can I put in water to soften it? I have used sal soda, but it will color the clothes yellow. A. This may be accomplished either by boiling the water for some time, or by the addition of the proper quantity of clear lime water. 2. What is used to bleach clothes in a short time without injury? A. In bleaching cotton goods, the first operation consists in scouring them in a slightly alkaline solution, or, what is better, by exposure to steam. They are afterwards put into a basket and rinsed in running water. The immersion of cotton in an alkaline ley, however it may be rinsed, always leaves with it an earthy deposit. It is well known that cotton bears the action of acids better than hemp or flax; that time is even necessary before the action of them can be prejudicial to it; and by taking advantage of this valuable property in regard to bleaching, means have been found to free it from the earthy deposit by pressing down the cotton goods in a very weak solution of sulphuric acid, and afterwards removing the acid by washing, lest too long remaining in it should destroy the cotton. 3. Is there any way of polishing shirts, collars, etc., besides the ordinary irons? A. Put a bit of paraffin, the size of a hazel nut, in each bowl of starch.

(27) D. A. D. asks: Can you give me the method by which Berthelot was able to obtain alcohol by synthesis? A. By the formation of a solution of olefiant gas in oil of vitriol, which dissolves about 120 times its bulk of the gas, then diluting the mixture and submitting it to distillation. Small quantities of dilute alcohol are thus obtained with facility. Triethyl alcohol has been obtained by acting on triethylene in a similar manner.

(28) H. W. says: In your answer to A.C.R. you say that, if the first floor is set high up from the ground and is ventilated, the probabilities as to health are in favor of the house with no cellar. The fact is that a great many dwellings are built on solid and close foundations and without ventilation, and the real question is: Are they healthy? I think not. In Illinois, there were three settlements within visiting distance of each other, altogether containing about 30 families. One fall every family of the three settlements (with one exception) was sick with the prevailing fever of the season. The excepted household had an upper floor to their house (a half story) which was used for sleeping in by all the family, consisting of parents, 3 children, and a workman, and they all escaped the fever. All the rest of the inhabitants lived in one story houses, and of course slept and kept all the stores on one floor. In a house with a close solid foundation, we found that things would mold if left standing for a few days. Preserves, placed upon a top shelf, in a short time became moldy; but when placed in the second story, they all kept well. A barrel of flour was kept standing on the floor; when about two thirds used, the sponge failed to rise, and as a consequence we lost two bakings of bread, it not being fit to eat. The barrel and flour were then taken out of doors and placed in the sun, so that the air could circulate freely around and under it, and after standing thus about 6 hours, it was replaced on the floor and set on two strips of board one inch thick. By this means the flour was wholly restored and rendered good to the last. I could cite many other instances. A. All receptacles for foul air under or near a dwelling should be very closely attended to, and so opened as to be thoroughly ventilated, as the instances cited by our correspondent very fully illustrate.

(29) S. V. C. asks: If a student learns telegraphy on a Tom Thumb electric instrument, will he be able to work an ordinary railroad office instrument correctly? A. If a student learns to read well by sound, he can operate in any office where sound instruments are used.

(30) A. K. asks: Is the beech tree a negative or a positive pole, or is it a conductor of electricity? I lived for 25 years where one fourth of the timber was beech, and never saw one that was injured by lightning. A. The beech tree has no polarity; but it is a good conductor when green and full of sap.

(31) F. C. B. asks: How are those batteries made in which lead is one of the elements, and what is the solution? A. Similar to the Callaud, using sulphate of copper solution.

(32) C. J. M. asks: 1. Can you give me directions for making a constant battery for ringing an electric bell occasionally on a circuit of 350 feet? A. Use any form of a sulphate of copper battery. 2. What size of wire, and how much, shall I use on the poles of an electro-magnet, to be operated with the above battery and circuit? A. Use 200 feet of No. 24 insulated copper wire.

(33) E. A. D. says: I wish to deposit copper on a very frail non-metallic substance. I cannot apply plumbago, nor use any composition in which phosphorus occurs. The application to render the article a conductor must be in a liquid state. Is there such an article? A. Have you tried soaking your model in melted paraffin, and then applying plumbago?

(34) A. F. B. asks: 1. What size of insulated wire will give the best effect on an electromagnet, with an iron core $\frac{3}{4}$ of an inch in diameter? A. It all depends upon what use you wish to put it to. 2. Would an electromagnet made of one bar, bent in the form of a U, be more powerful than one made of two bars, and the ends connected by an armature, other things being equal? A. No.

(35) J. E. M. says: 1. If I have two pairs of magnets, and one pair, placed at a distance of $\frac{3}{4}$ inch apart, will be drawn together, and the other pair will be drawn together if placed 1 inch apart? If both pairs were placed an equal distance apart, say $\frac{1}{2}$ inch, would not the weaker magnets be drawn together with as great rapidity as the stronger? A. No. 2. If I were to place a permanent steel magnet without a keeper inside a hollow glass globe, and then exhaust the air from the globe, would the attractive power of the magnet remain exactly the same? A. Yes.

(36) J. W. McM. says: I have an electro-magnetic machine. The battery consists of two zinc plates with a thin platinum plate between them, and the platinum plate has been destroyed by the acid. Would not a copper plate answer the same purpose? If so, should it be the same thickness as the platinum one, or thicker? The acid is dilute sulphuric. A. Copper will not answer; use a thin plate of silver.

(37) J. E. L. says: I have a hot air furnace which warms 16 rooms. It is set in brick double walls, the inside wall being 16 inches from the radiator. I would like to sometimes draw the hot air from the hall; so I put a 10x14 register and a 9 inch tin pipe down to the bottom of the outside wall, and a damper in the outdoor cold air box. I closed the damper to see if it worked, but it did not; then I closed the registers, but I left 3 openings, and it will draw the air from the hall through one of the hot air registers. A. It is necessary to keep a free circulation of air between the rooms and hall; the air will then descend through the lowest register.

(38) C. W. E. asks: What substance is the best non-conductor of magnetism? A. We do not know of any.

(39) A. N. W. asks: 1. What is the most lasting and cheapest battery that I can work an alarm bell with, with No. 20 fine copper wire in a circuit of about 100 feet? A. Since's or Lelanché's. 2. In using one of Grove's cells, if I take out the platinum plate and amalgamated zinc, will the mixture of the two acids impair the strength of battery?

(40) I. M. L. says: 1. I have a line 650 feet long of No. 12 galvanized wire, with 3 relays of 55 ohms each on the line. How many Hill's jars will be needed? A. Three. 2. With a line of a given length, with 3 relays of 55 ohms each, if I replace the relays with 8 of 100 ohms each, will it require more or less battery? A. Less.

(41) W. D. says: A fair trial of galvanized iron for roofs has had very unsatisfactory results in Canada. Under the contracting and expanding influence of heat and cold, the cross joints open, and leakage on the first thaw is the result. Even the gutters on mansard roofs part at all the joints, and have utterly failed for the purpose intended, to the great annoyance of those who have either recommended or used this material. One method has been to solder and rivet the joints, the rivets being about $\frac{3}{4}$ or 1 inch apart, but in spite of this the seam opens visibly. What is the remedy? A. In this vicinity, tin in small sheets is almost universally used for the purpose. The tin is clinched and soldered in the usual way. The smaller the sheets, the less the effect of the contraction and expansion on the joints. Galvanized iron is used for cornices and other molded work.

(42) A. M. S. says: I have a large Newfoundland dog who has a constant disagreeable smell. Can you tell me how to remove it? A. Wash him with carbolic soap.

(43) C. W. H. says: We have a copper tank, and an ordinary brick and cement cistern for holding water. The water in the copper tank is much softer than that in the cistern. The water in the cistern probably takes up some of the lime from the sides and bottom of the cistern. Can a cistern be covered with silicate of soda or with paraffin, and thus avoid the trouble? A. A coat of hydraulic cement will be the best remedy for the difficulty.

(44) H. F. N. asks: Is there any substitute for oil for drilling cast steel and wrought iron? A. Soapy water is sometimes used.

1. Is it an established fact that there should be no oil used in the steam chest or cylinder of an engine? A. No. 2. If grease is needed, which is the best, oil or tallow? A. Tallow.

(45) C. T. asks: Would any mechanical contrivance which supplied the power which kept it in motion be deemed perpetual? A. Yes.

(46) F. W. J. asks: What will weld iron and steel together without the aid of sand or borax? A. Brush clean with a wire brush frequently while heating, and when taken out to weld.

(47) J. P. says: I have an engine of 3 inches bore by 4 inches stroke, and I am thinking of making a boat, 25 feet long x 4 $\frac{1}{2}$ or 5 feet beam, with 2 feet depth of hull. I propose to make a boiler 4 feet long by 22 inches diameter, with a 13 inch flue running the whole length. I set my grate inside the flue to run about 16 inches back. Shell and flue are of $\frac{3}{16}$ inch, heads of $\frac{1}{4}$ inch, charcoal iron. What steam pressure can I carry? A. You can carry 75 lbs. of steam. 2. At what speed (in still water) can I run? A. Probably 6 or 8 miles per hour. The other engines you describe may answer for a boat 14 to 16 feet long. The inclination of shaft and position of propeller depend greatly on the design of the hull.

(48) W. H. S. asks: 1. In making hydrogen from sulphuric acid and zinc, for an oxyhydrogen light, will a plain bottle do for a vessel? A. Yes. 2. What is the proportion of commercial acid to water? A. About 18-5 per cent water.

(49) B. J. says: Please state the diameter of eccentric of engine described on p. 37, vol. 32. A. Five inches.

(50) W. W. D. asks: How large a boat could I run with side wheels 3 feet in diameter, and an engine of 8 inches stroke by 4 inches bore, with 60 lbs. of steam? A. From 25 to 30 feet long.

(51) W. F. H. asks: 1. How high can water be raised in a cast iron pipe, a vacuum being produced in top of pipe by the escape of steam, as in an ordinary steam siphon? A. From 20 to 25 feet. 2. What length of time is required to raise water to any given height by such means, steam being at 75 lbs. pressure in boiler, and the pipe, through which the water is to be raised, of 30 inches diameter? A. Less than a minute, with plenty of steam. 3. Is this way of producing a vacuum economical? A. Not very.

(52) J. M. says: 1. I intend building a scow 90 feet long x 20 feet wide, with stern wheel. What size of engine would you advise me to get? A. An engine with cylinder 15x15 will do. 2. What size of stern wheel will be necessary, the above mentioned scow drawing 4 feet when light, and running at 6 miles per hour? A. One of from 8 to 10 feet diameter.

(53) C. D. P. asks: We wish to warm a church, 40 feet by 70 feet by 18 feet high, with a furnace in the basement. The smoke flue will run nearly horizontally for about 20 feet from the furnace, where it enters the perpendicular flue. What should be the dimensions of the horizontal smoke pipe and of the chimney? A. The smoke pipe may be 10 inches in diameter, and the chimney flue 12 by 12 inches.

(54) J. W. W. asks: To what depth can a diver descend in the Atlantic Ocean, using a diving bell? A. We could not fix the limit. It would depend on the weight of the bells and the capacity of the compressing pumps.

(55) J. J. H. asks: 1. By what standard are shot guns gauged? A.

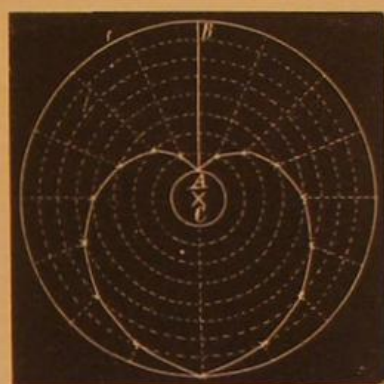
No. of gauge.	Diam. of box in inches.	No. of gauge.	Diam. of box in inches.
5.....	0.98	19.....	0.65+
6.....	0.92+	20.....	0.63+
7.....	0.89	21.....	0.63
8.....	0.84+	22.....	0.62+
9.....	0.80+	23.....	0.61+
10.....	0.79	24.....	0.61
11.....	0.76+	25.....	0.60+
12.....	0.75+	26.....	0.59+
13.....	0.73+	27.....	0.59
14.....	0.71+	28.....	0.58+
15.....	0.70+	29.....	0.57+
16.....	0.68+	30.....	0.57
17.....	0.67+	31.....	0.56+
18.....	0.66	32.....	0.55+

2. By what standard are shot numbered? A.

No.	Diameter in inches.	No.	Diameter in inches.	No.	Diameter in inches.
12.....	0.05	5.....	0.12	B B.....	0.18
11.....	0.06	4.....	0.13	B B B.....	0.19
10.....	0.07	3.....	0.14	T.....	0.29
9.....	0.08	2.....	0.15	T T.....	0.21
8.....	0.09	1.....	0.16	F.....	0.22
7.....	0.16	B.....	0.17	F F.....	0.23
6.....	0.11				

3. How are the qualities of gunpowder numbered? A. Each maker has his own standard. The United States standard is as follows: Musket, grains between 0.03 and 0.06 inches. Mortar, grains between 0.06 and 0.10 inches. Cannon, grains between 0.25 and 0.35 inches. Mammoth, grains between 0.60 and 0.90 inches.

(56) F. H. F. asks: Please give me a rule describing a heart cam that will give a perfectly uniform motion and at the same time be easily driven? A. Divide the length of stroke, A B, into any number of equal parts, and describe circles through the points of division, from C, the center



on which the cam turns. Divide the outer circle into twice as many equal parts as A B was divided into, and draw radii from the points of division. The points in which these radii cut the corresponding circles are points of the cam.

(57) A. L. F. asks: How many horse power will an engine of 18 inches cylinder by 3 feet stroke at 60 turns a minute, with steam cut-off at $\frac{3}{4}$ stroke, and pressure at 60 lbs. per square inch, give? A. This question can only be answered definitely by experiment. All we could do from the data sent would be to guess at the mean effective pressure. You can do this if you like, thus: Product of mean effective pressure in pounds per square inch x area of piston in square inches x speed of piston in feet per minute = 33,000 will give the horse power.

(58) J. H. K. asks: How can I find the logarithm of a number, say 25, without using a book of tables? A. The formula is as follows: Let $a =$ any number. Then $\log\left(\frac{a}{a-1}\right) = 0.868589 \times \left\{ \frac{1}{2a-1} + \frac{1}{5 \times (2a-1)^3} + \frac{1}{5 \times (2a-1)^5} + \frac{1}{7 \times (2a-1)^7} + \text{etc.} \right\}$ In the particular case mentioned, $\log 25 = 0.868589 \times \left\{ \frac{12}{13} + \frac{1}{3} \times \left(\frac{12}{13}\right)^3 + \frac{1}{5} \times \left(\frac{12}{13}\right)^5 + \frac{1}{7} \times \left(\frac{12}{13}\right)^7 + \text{etc.} \right\}$

You can work this out if you feel inclined; but we imagine that you will not care to use this formula for finding the logarithms of many numbers.

(59) A. L. K. says: 1. There is a sawmill with two engines and two sets of boilers, each set having an iron smoke stack 65 feet high x 56 inches diameter. One set of boilers have two flues in each, the other set are plain cylinders. All burn sawdust. The latter have good draft, but the other, in heavy weather, will not keep up steam well. The question is whether, if one of the exhaust pipes (7 inches in diameter) is inserted in the flue boiler stack, the draft will be improved. A. It is very probable that the change will improve the draft. 2. If so, at what distance from bottom should the exhaust enter the stack? A. Insert the pipe so that it discharges a little above the top of the boilers.

(60) F. J. asks: 1. What is the best size, form, and material for a boiler for an engine with cylinder $\frac{3}{4}$ inch diameter by $\frac{1}{4}$ inches stroke? A. Make it of copper, upright, with a flue in the center. 2. What is the best manner of heating? A. Use charcoal for fuel.

(61) J. P. asks: Will it require more power to drive a paddle boat, of two hulls, like the Catalpa, than one large hull of the same draft and beam? A. It will take more power for the double hull.

(62) J. M. asks: 1. About what length, when folded up, would Peaucellier's parallel motion have to be to describe an arc of a circle of 5 feet radius? A. Between 7 and 8 feet long. 2. In what work are quarter twist bells illustrated? A. In Rankine's "Machinery and Millwork." 3. Are Rankine's works of any use to any one except those who understand algebra? A. In "Rules and Tables" scarcely any of the rules are expressed algebraically.

(63) C. P. says: Two pipes, the shells of which are of equal thickness, the diameter of one being one foot, the other one hundred feet, the pipes being filled from the top by forcing water in: which will burst first, and at what height? A. If the material in the pipes is of equal strength throughout, the largest pipe will burst first, as the strength of a pipe to resist rupture varies inversely as the diameter; and it will burst at the bottom, as the pressure is greatest there.

(64) C. P. W. asks: Having had a controversy about balanced slide valves, I write for your opinion. If we place one valve, as usually used, over the ports of an engine, and make an exact duplicate and attach it to the other, the two valves being back to back, so that one will make a steam joint on the cover of the steam chest while the other makes a similar joint over the ports, will we have a balanced port? A. We think not, if you mean a perfectly balanced one.

(65) E. M. says: I have an engine with a $2\frac{1}{2} \times 5$ inches cylinder, capable of running from 400 to 600 revolutions per minute. What should be the diameter and pitch of screw, and the length and width of a boat, for such an engine, and how much water ought she to draw? A. You can make the boat from 15 to 18 feet long, 5 to $5\frac{1}{2}$ feet beam. Propeller, 22 inches diameter, with $2\frac{1}{2}$ feet pitch. Boiler, 2 feet diameter, 3 feet high.

(66) W. S. asks: Can water be injected in to a boiler above the water line? A. Yes. 2. And what is the lowest pressure by which an injector may be worked? A. This will depend upon the construction of the injector, several forms being in use.

(67) H. W. S. asks: 1. I am about to put in a turbine water wheel, using 75 inches water in a circular sawmill, under 16 feet head; the wheel will be 40 feet from the dam, and the water conducted to the wheel through a round tube of 3 feet internal diameter, the tube sloping down to the wheel. In closing the gate of the wheel suddenly, will the momentum or shock, caused by the sudden stoppage of the flow of water, strain or injure the tube, and will a safety valve be necessary near the wheel? A. In closing the gate with moderate speed, no safety valve will be necessary; but when the closure takes place instantaneously, you can provide a stand pipe, three or four feet high, containing air, which will act as a cushion. 2. Would the 3 feet diameter tube be large enough for a wheel using 75 inches water, under 16 feet head? A. Yes. 3. Would friction gear answer well to run an edging saw for edging stuff from 1 to 4 inches thick? A. Yes. 4. My neighbor has a turbine wheel 4 feet in diameter, venting 200 inches of water, under 17 feet head, taking the water through an incline tube of 3 feet internal diameter and 200 feet long; the wheel under this head is rated by the builder at 70 horse power, but with the gate wide open it will not run one run of stones. What is the matter with it? A. The wheel may be choked, or some of the parts jammed.

(68) F. W. asks: I am about to put up a greenhouse; and in constructing the sides and ends I propose to place, on the outside of the posts and studding, one inch plank, to this put on a sheeting of tar paper, and on this ordinary flooring. Will this answer the same purpose, in every respect, as putting the inch boards on the inside of the posts, the flooring on the outside, and fill in the space, of say 4 inches, with sawdust? A. The sawdust filling is likely to be the warmer of the two.

(69) L. R. B. asks: What power does the engine whose piston is below the center of the axle exert on a locomotive? I claim that the engine whose piston is moving ahead and whose crank wrist is above the center of axle is the only one which is doing any service. A. The effect is the same, whether the crank is above or below the center.

(70) E. R. M. asks: 1. How can I make a battery that will last a good while without needing renewing, and be always ready for use? A. The Minotti is one of the best forms of battery for this purpose. 2. Of the ordinary liquid batteries, which is the most powerful? A. The Grove or Bunsen is the strongest.

(71) C. L. T. asks: How are letters placed on glass in street advertising by the calcium light? A. The plain letterings are painted or written, and the more elaborate ones are photographed, on the glass.

(72) T. A. P. asks: How can I construct a small and cheap camera obscura for sketching objects at short distances? I have a common two inch burning lens, and a plane reflector, 4 by 6 inches. Will these answer? A. These will answer the purpose very well. Take a small close box painted black on the inside, in an aperture in the top of which place your lens, and over this your reflector at an angle of 45°.

What is the best recipe for green ink? A. Digest 1 part of gamboge with from 7 to 10 parts of blue ink.

(73) J. E. B. asks: Where oils, reduced or cut with alcohol, are added to plain sirup, how can I prevent the mixture from becoming cloudy? A. The sirup does not dissolve freely in your oil and alcohol, and the remedy is not to add them.

(74) G. B. A. asks: What is the best preparation for rendering cotton fireproof? A. A solution of tungstate of soda is highly recommended.

(75) D. B. B. says, in reply to J. G. R., who asks how to construct a cheap oxyhydrogen blow pipe: Take a round piece of wood about 4 inches long and 1 inch thick, and two brass tubes about 5 inches long; to an end of each of the tubes attach a gun nipple. Bore holes in the wood obliquely, and of such a diameter that the brass tubes, when inserted, do not move easily. Bring the gun nipples to about three eighths of an inch apart. The bore of the gun nipple of the hydrogen tube must be the larger, so as to allow twice as much gas as comes from the oxygen tube to escape.

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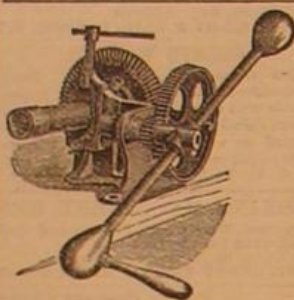
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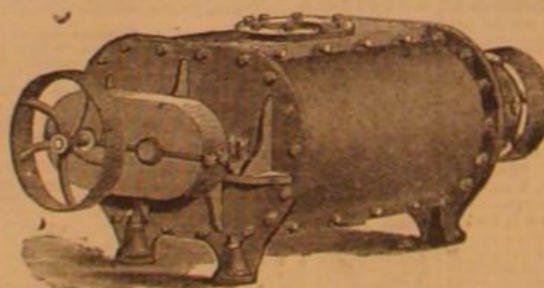
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NEW YORK, MAY 8, 1875.

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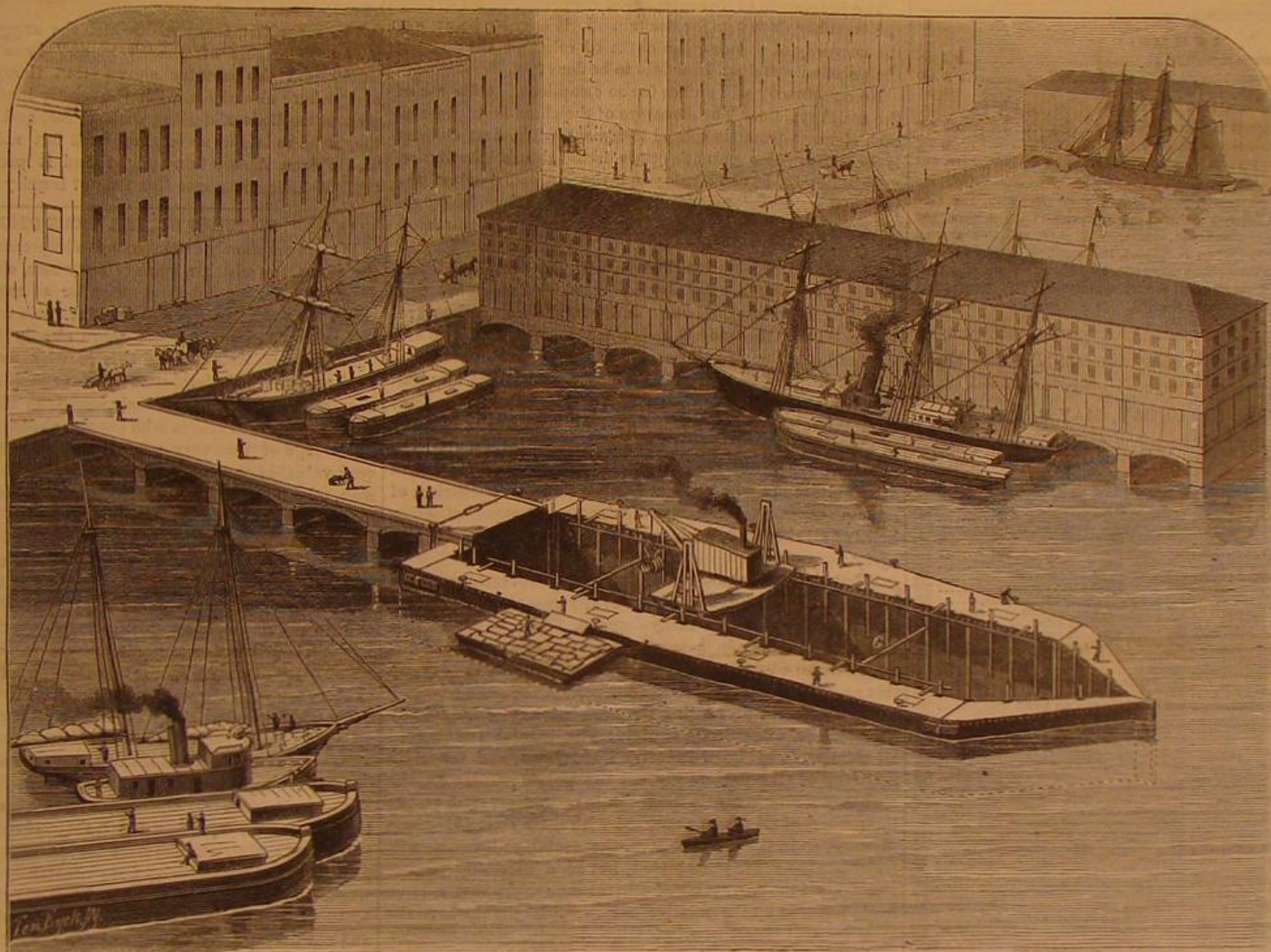
This invention is a portable coffer dam of a construction which offers improved facilities for the excavation of tunnels, building of bridge supports, piers, sea walls, or other marine structures. It is formed of watertight compartments which, when the apparatus is to be towed from one point to

conform, in its lower portion, to the irregularities of the bed, and thus tends greatly to prevent the infiltration of water.

The large engraving, Fig. 1, represents the dam in position for the construction of a pier, the dotted lines indicating the depth of the structure. The forward portion is shaped somewhat like the bow of a vessel, by connecting together

will be obvious from the fact that the parts can be adjusted at any desired distance from each other, to accommodate varying breadths in masonry, etc., and by means of the transverse screw clamping rods, F, Fig. 2, solidly held.

The removal of the earth within is effected by simple dredging apparatus, which lifts out the soil and empties



WALSH'S COFFER DAM.

another, are filled with air only; but when it is desired to locate the dam, water is admitted into the sections, causing the entire structure to sink and rest on the bottom. The prin

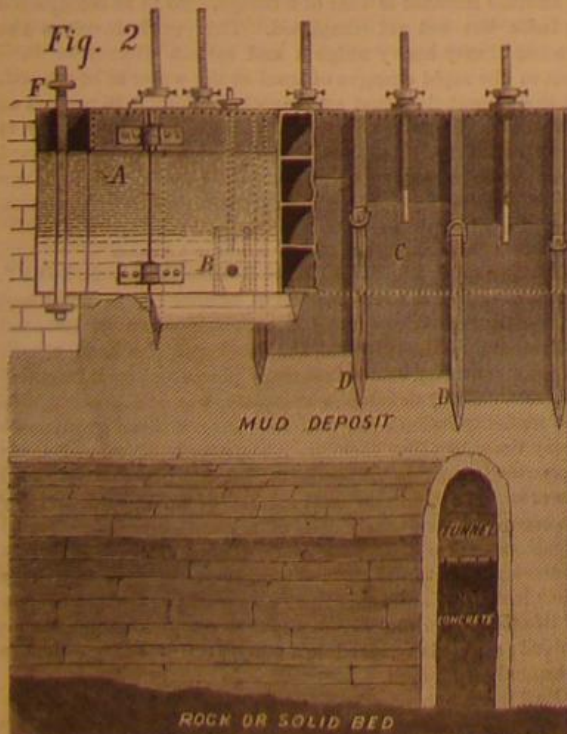
two hinged gates, formed of metal, and each constituting a compartment similar to those into which the body of the dam is divided. The rear portion of the structure is provided with similar doors, made so as to secure and fit tightly against the sides of the pier end, being secured by screw clamp rods, which embrace the ends of heavy posts.

The manner in which the body is constructed in sections is shown in Figs. 2 and 3. In the latter engraving are represented the rear gates, at A; and at B, in both figures, are the valves which admit water to the compartments to sink the same. At C, Fig. 2, are the plate piles, which are raised or lowered by the screws attached to their upper portions. D are the holding piles, which are guided by, and slide upon, T irons that are secured to inner plating of the body. Extending around and underneath the middle portion of the latter is a keel, E, which serves to take a firm hold in the bottom, thereby giving greater security to the structure.

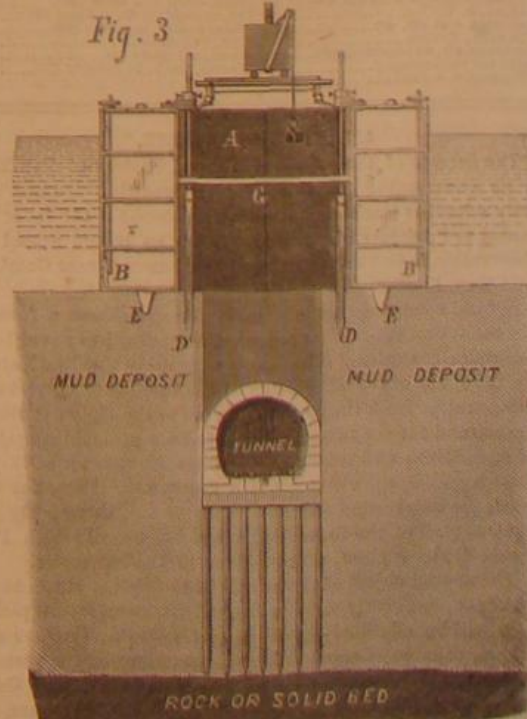
On top, and secured parallel to the decks and over the open middle portion, a track is laid, to support a dredge and pile drivers which travel thereon. Lastly, clamping bars extend across the inner part at G, Fig. 3, and at other points, serving to bind the sides together and give solidity to the fabric.

In order to prepare the dam for pier or tunnel building, the sheet and square piles are first raised so that their lower edges and ends will be above the bottom of the sections. The latter being empty, the dam is easily floated to the desired point, where it is sunk as already described. The square piles are then forced into the earth to form a solid bearing, the sheet piles being driven in until bed rock, if necessary, is reached. The water in the middle space being pumped out, the building operations may be begun at once, and, if a pier, the work carried on until the entire space is filled. To extend the masonry further out into the water, the piles are raised, and the dam floated and towed ahead until its rear gates embrace once more just the extremity of the structure, when the dam is again sunk and the work continued. The advantage of building the dam in two sections

clear of the decks, returning the same on top of the tunnel arch, as shown in Fig. 2, after the mason work is finished. The invention offers many practical advantages, both in



cipal feature of the invention is the system of plate piles which surround the interior sides, and which may be forced down below the bottom of the dam and into the mud for a considerable depth. These, besides, enable the apparatus to



point of economy and convenience, which will doubtless be evident to engineers generally.

The two engravings, Figs. 2 and 3, also show the two methods by which, the inventor suggests, a tunnel by the aid of

his apparatus may be constructed. In Fig. 2, piles are driven down into the mud, etc., until their lower ends meet hard pan, and above them the masonry of the tunnel is built, as shown, concrete being placed over all. The other plan, in Fig. 3, involves digging down directly to bed rock, and building masonry therefrom upward, filling in the lower part with concrete, up to the desired level of the tunnel floor.

The invention is covered by four separate patents, granted to Mr. John E. Walsh, of 333 West street, New York city, to whom inquiries for further particulars may be addressed.

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AN INLAND PENIKESSE.

The success of the School of Natural History at Penikese is an encouraging indication of the growing demand for truly scientific teaching. Another indication is the favor accorded to Professor Shaler's project for an inland school of observation, to be located in the coming summer near Cumberland Gap, Ky.

Several conditions unite to make the site chosen a favorable one for an out-of-door school. The region has never been scientifically explored: the Gap is admirably fitted by Nature for the study of a great section of the fossil-bearing rocks of this country, from the Lower Silurian to the Upper Carboniferous, and for the investigation of the Appalachian system of mountains; and subsistence is incredibly cheap, milk ten cents a gallon, eggs five cents a dozen, etc. Last, but not least, the cooperation and assistance of the thoroughly organized staff of the State Geological Survey, of which Professor Shaler is chief, will be given to the enterprise.

The special object of the school is to teach students to observe; consequently only a limited number (25) of picked men will be admitted—graduates of colleges, teachers and others, capable of appreciating and profiting by the instruction given. Among the instructors will be Dr. Asa Gray, Professor J. D. Whitney, Rafael Pumpelly, and others, besides the members of the State Surveying Corps. The various departments of geology will be chiefly studied, but only with a view to the elucidation of the problems presented by the area under exploration. Some attention will also be given to the zoology and botany of the district.

As might have been expected, the applications have been far in excess of the number that can be accepted. If successful—and it can hardly fail to be—this camp school is likely to become a permanent institution, with a new camp ground every year.

THE CHAIN OF CRIMINAL ENTAILMENT.

Having studied crime and criminals for thirty years, the New York State Prison Association concludes (in its annual report, just presented to the Legislature) that to reduce the criminal classes and break up the entailment of the evils of pauperism and crime, "which defy remedies and curative discipline in adult lives," two things are specially required, namely to sever the links in the chain of such entailed evils, and to instruct, train, and save all the children.

To use a homely saying, it is saving at the spigot and wasting at the bung to attempt the repression of crime solely through action upon adult criminals. So long as the chain of criminal entailment is unbroken, the most searching and rigorous police system possible is powerless to purge the community of evil acts and evil tendencies.

The judgments of the association are sound, so far as they go: but they do not go far enough. It is easy to point out the necessity of severing the chain of criminal entailment; the question remains: How is it to be done?

No one remedy will suffice for so complicated a disease of the social system. The structure of the chain is triple, and each element demands special treatment. The first element is heredity. The parent's crime is the child's inheritance, not absolutely, but as a rule; and the chances against the proper moral development of the progeny of the vicious are so overwhelming that it were better for the world were such children never born.

The second element is miseducation. By conscious teaching or unconscious example, the criminal classes are continually corrupting the honest and contaminating the pure. The child of virtue may thus become a monster of vice and the head of a line of evil doers.

The third element is what we may call moral atavism. Constitutional virtue is the product of long culture, the fruit of moral habits covering many generations. Yet, as in herds of blooded stock there will be an occasional reversion to the primitive type, so in good families there will now and then arise children in whose moral composition the barbarism of remote ancestry strangely dominates. Instead of being heirs of all the ages, such unfortunates inherit only savagery.

What the causes and conditions of such reversions are, no one knows, though the fact is painfully patent in the "black sheep" which afflict so many domestic flocks, boys and girls who turn out badly in spite of virtuous parentage and the most careful education. Time alone can cut off or dry up this source of crime.

The means for preventing the production of criminals by education or example are twofold: The careful training of all children in habits of industry and virtue, and the rigid seclusion of all offenders against the public weal. As the community now compels the absolute retirement from public intercourse of all persons afflicted with malignant infectious diseases, so in time, we believe, the morally diseased will be isolated, not for punishment, but as a necessary precaution against the corrupting of others: a measure that will be made possible by the relative rareness of crime when the most fruitful source of criminality—hereditary transmission—shall have been dried up.

Herein lies the great problem of prison management, to isolate the evil-disposed so as to prevent depredations against the life and property of the law-abiding and the moral purity of youth, while making the criminal classes self-supporting and, at the same time, furthering so far as possible their reclamation to paths of virtue. On these points the views of the association show an encouraging progress toward what we have heretofore styled the scientific treatment of criminals.

Touching hereditary crime, the suggestions of the association are palliative merely. Given children born with a criminal bias, the best thing undoubtedly is to counteract, so far as may be, their evil tendencies by proper training in childhood and moral surroundings in later years. So far, good: but the time has come when preventive measures also should be considered. Is it possible to lessen the number of the inheritors of crime-compelling organizations by making their generation less frequent? In plainer words, can the community prevent known criminals from completing the chain of criminal entailment?

X, a male, and Y, a female, are convicted criminals, come of criminal parentage. In all human probability their children will be criminals. Has the community any right to allow the future to be afflicted with their pernicious progeny? We say: No, no more than they should be allowed to erect a house or build a dam in such a way as to imperil life and property ten years hence. That the resultant evils can be prevented in the one case as surely as in the other (not absolutely, but very largely), we are confident. The question is: Which of the several possible ways of doing it is most consistent with our modern views of what is just and profitable?

The summary execution of criminals of every grade would soon put an end to hereditary crime: so too would the Spartan custom of killing all suspicious or undesirable infants. But these remedies are so horrible, so obnoxious to our moral sentiments and sense of justice, that they are not to be thought of. Two other methods remain: To set apart all criminals permanently, in communities or colonies, with the sexes separated, as lepers are treated in the Sandwich Islands

or to eliminate their power of propagation, as suggested in our article on the generation of the wicked.

So long as the criminal classes are so numerous, their isolation is beset with many difficulties. The crime committed, not the character or moral needs of the criminal, determine the period of his seclusion. To sever the chain of heredity, the convict's imprisonment would have to be for life, regardless of the severity of his crime or the thoroughness of his subsequent reformation. This would require the capacity of the penal colonies to be immense and very burdensome to the innocent, since it would be only under peculiarly favorable circumstances that the isolated communities could be made self-supporting. Nevertheless prisons and penal colonies will always be needed, if not for punishment, at least for the separation of the criminally infected from the morally healthy, for the safety of youth.

Use would be found for them also as alternatives to the last named plan for breaking up the entailment of crime. The criminal might have the choice of the two preventives of heredity, loss of freedom with sexual isolation, or the enjoyment of civil liberty with sexual impotence. In either case the terrible stream of criminal entailment would largely cut off at its source.

The surprising favor with which the suggestions made in "The Generation of the Wicked" have been received throughout the country shows that thoughtful men are everywhere dissatisfied with the costly insufficiency of our present methods of dealing with crime, and convinced that they need to be not merely reformed but radically changed. The Prison Association might find it profitable to push their investigations into this field of inquiry also.

PICTURES BETTER THAN STORIES.

We are constantly endeavoring to impress upon our readers the advantage which a picture possesses, either as a direct substitute for verbal description or as explanatory of the same. A rough sketch will, in nine cases out of ten, convey one person's idea to another more clearly than pages of labor, written details; and this is why we ask people who send us questions about machines, or mathematical or mechanical problems, to use their pencils as much as possible; while we counsel others who cannot sketch to acquire some knowledge of that very useful accomplishment. Time is a very valuable commodity; and the mechanic or professional man, whose leisure time is seldom great, has little liking for poring over a long description when half a dozen lines, in the form of a sketch, will enable him to seize the gist of the idea in perhaps as many seconds. This is one of the reasons why we advise the inventor, who has a new idea to show to the world, to exhibit it by a picture whenever possible, and to distribute that picture widely among the people whom his production is likely to interest.

The value of pictures, or rather their superiority over words, as story tellers, is excellently illustrated by a couple of incidents which we find related in a foreign contemporary. In a village in India, recently, it became necessary in the course of some engineering operations to transport an enormous mass of metal, weighing several hundred tons, from one point of the town to another. Ordinary means were out of the question; and as the engineers found themselves unable to devise any process, they did the next best thing, and wrote to other engineers in England who were constantly supervising such work. The latter, instead of writing out nice large pages of foolscap, beautifully embellished with Greek letter formulae and red ink, quietly waited until the next big piece of metal which they had to transport offered a favorable opportunity. Then they prepared a camera, and photographed every step of the operation, together with all the tools and appurtenances and forwarded the prints from the negatives to India. These the engineers in the far-off country followed, and with little difficulty accomplished their task.

Another instance is that of a bridge, also to be constructed in India but not yet completed. This work involves the placing of very heavy weights and certain difficulties incident to the rapid changes of level of the water to be crossed. At the present time just such another bridge is in process of erection in London, and the assistance of photography is again called in. As the London bridge advances toward completion, photographs are constantly made; and so when the Indian engineers begin their work, they will be in possession of a set of guides of invaluable assistance to them.

SOME CURIOUS RESULTS OF EXPERIMENTAL SURGERY.

The power of the lower forms of animal life to withstand mutilation is well known. Cut an angle worm in two, and the tail end will reproduce the head and the head a tail. Other worms may be cut into many pieces and each fragment will straightway develop a complete worm. A polyp will endure decapitation a score of times, a new head growing on every time. In like manner, the stomach of one of these creatures is capable of developing all the other parts. Still lower in the scale, the normal method of multiplication is by division, and elementary cells of more highly differentiated organisms seem to retain more or less of the primitive character. By virtue of this inheritance, spiders reproduce their lost limbs and crabs their claws. In the higher forms of life, the power diminishes so far as complex organs are involved; still it is retained to a much greater degree than is commonly supposed.

Pull out a hair or a finger nail, and it will grow again. Remove a portion of the skin and it will be renewed, unless the wound is too broad or the life of the surrounding parts too feeble. Even then it is possible to transplant to the denuded surface minute particles of skin from other parts, and in a short time these epidermic islands will extend their borders until the wound is covered and the sore heals with scarcely

a scar. In like manner a severed finger may be made to grow together again, and an amputated nose built up in form with live flesh from the cheek.

In such cases muscular fibers as well as skin are restored or reunited by internal growth. This may be observed also wherever a deep cut is healed. It has been found, too, that the muscular tissues which perform involuntary motions in the interior of the body possess the same power of self-restoration. It is this recuperative faculty which enables the cattle of Abyssinia to supply their barbarous owners with steaks without losing their lives. The hungry savage throws his ox upon the ground, makes a cross cut in the skin of the flank, lifts the skin and cuts out a chunk of beef for his dinner, replaces the skin, and drives on rejoicing, trusting to internal growth to restore the mutilated part to health and soundness.

In every wound of the skin or muscle, nerves are severed. The restoration of the functions of feeling and motion, with the progressive healing of the wound, shows that the nerves are likewise capable of repair. The renewal of nerve connection has been watched in cases, where, as is sometimes necessary, a section of a large nerve has been cut out. In a couple of months after the nerve is cut, a gray lump appears on one extremity of the severed nerve. Growth proceeds towards the opposite nerve end until a new connection is made, at first more slender than the original; but by degrees the nerve elements increase in size and whiteness, until, in from four to six months, the nervous cord is fully restored. This process, it is said, goes on even when two inches of nerve has been excised.

About a dozen years ago it was demonstrated that cartilage, formerly supposed to be incapable of renovation, was also subject to the same laws. The cartilaginous tissue of dogs and rabbits was divided, and at the end of two months was found to be completely restored. Similarly the tendons by which muscles are attached to bones are able to reunite when severed or torn out: a fortunate circumstance for a prominent clergyman of this city, whose *tendo Achillis* was suddenly snapped while walking along the street one day last winter, thus making his foot temporarily useless. Thanks however, to the gradual reunion of the tendon, the crippled limb will in time be restored to usefulness.

Still more remarkable is the restoration of bones, and even the development of bones in abnormal positions by the transplanting of the periosteum, the membrane surrounding bony structures and the principal agent in elaborating them. Formerly, in case of a badly shattered or diseased bone, the amputation of the limb was the only resource. Now the skillful surgeon excavates the damaged parts; and in a few months the limb, which has never lost its form, repairs its losses, and regains its strength. Attempts have also been made to graft healthy bones in place of diseased ones, but they have fallen short of perfect success. The transplanting of teeth has been more successful, and partial success has attended the reproduction of teeth by a sort of budding process. In its natural development, a tooth springs from a little bay or follicle, containing an organ or germ for the production of the ivory of the tooth and one for the enamel. The entire follicle taken from a puppy and grafted into the jaw of an adult dog continues its development, and a perfect tooth is the result. Doubtless the same would occur in human jaws, and possibly the dentist of the future will be prepared to set the germ of a new tooth in the place of each one he extracts, giving the patient a choice of the whole range of mammalian dentition!

Among the curiosities of this sort of surgery, we may mention the trumpet-nosed rats with which a waggish student puzzled the naturalists of Paris. By grafting the tip of one rat's tail into the snout of another rat, he produced a nondescript creature with a trumpet-shaped proboscis, for which it had no use; yet the connection of the nerves and blood vessels was complete, and the sensibility of the part so keen as to preclude the idea of mechanical attachment. Similarly cock's combs have been furnished with teeth and spurs by transplanting.

THE RECENT REMARKABLE PROGRESS IN THE STEEL INDUSTRY.

We are inclined to believe that very few of our readers have any idea of the immense progress which has been made in the steel industry in this section of the country during the past few months. When we state that American pig has been obtained as low as \$32 per ton, from which the rails produced included but one per cent of second quality, as against imported pig at \$65 per ton, which yielded from ten to twelve per cent of second quality rails, eighteen months ago, we need hardly point out that competition, under these conditions, is out of the question, and that the foreign metal in our markets bids fair to lose whatever footing it may still possess. Add to the above that, with the exception of such as has been necessary to complete old contracts, no English rails have been imported into this country for some nine months, and that the importation has without doubt ceased for ever, that the Grand Trunk Railway of Canada, whose president and many of whose directors are heavy stockholders in the great Barrow plant, have found it to their interest to order 6,500 tons of rails from the works in Troy, N. Y., rather than send to England, and that 120,000 tons of ore, from which steel can be at once produced, with anthracite coal and without admixture of other ores, can be annually mined at the Crown Point mine in this State; and perhaps we have adduced sufficient instances to bear us out in the view that the steel production of this country is rapidly advancing toward a point of close competition with that of Great Britain.

It is well to bear in mind that the extraordinary strides

which we have indicated have mainly taken place since the exploitation of the Crown Point mine, near Lake Champlain, in New York State, and have been aided by the consolidation of the two great iron-making establishments of Troy, formerly under the control of Messrs. Erastus Corning and John A. Griswold, into one great corporation, now known as the Albany and Rensselaer Iron and Steel Company. The ore of the mine above mentioned is of singular purity, and so well adapted for steel making that it finds a market in the heart of the Pennsylvania iron district, no less than 40,000 tons being sent thither during the present year. The Port Henry product yields seventy per cent in the furnace, and the deposit is seemingly inexhaustible. The ore, however, is not capable of being smelted into steel. There is a single wall, 235 feet high by 300 feet face, of ore, while the roof is supported by pillars of ore, each containing from sixty to seventy-five thousand tons. Upwards of \$2,000,000, we are informed, have been spent in developing these resources.

The consolidated works above mentioned use up about 100,000 tons of pig metal yearly, and can produce about 24,000 tons of the same from their own furnaces. Their coal expenditure is in the neighborhood of 150,000 tons.

The melting of pig for conversion is about 300 tons per day, and the product of steel rails 1,100 tons, or two and a half miles, per week, two five ton converters literally turning out as many ingots in weight as is accomplished in Barrow with seven converters of like size. The metal is cast in ingots weighing a ton each, and from the time it leaves the cupola it never stops until it results in a finished bloom. Hammers are abolished and rolls substituted, and herein lies one of the important causes of the reduced cost and improved quality of the product. The latter is, by the drawing in lieu of the pounding process, rendered far more homogeneous and far more uniform throughout; while the celerity of the operation, due to the novel machinery which has been introduced, is certainly most remarkable. Each ingot makes three rails, and the bar, which on entering the rolls is thirteen inches square, is reduced to six inches in a single heat. The time occupied by the steel in changing from the bloom to a finished rail is one minute and thirty seconds. It is impossible, within the limits of this article, to describe the tables on which the metal is lifted, or the automatic fingers which turn it to present it to the rolls, or, indeed, any of the ingenious mechanism which reduces the labor of eighteen men to that of one man and a boy, and handles the great masses as if they were feathers. This we reserve for a future time, when the pencil of the artist can aid our explanation, and when we shall be enabled to tell how ingots weighing two tons instead of one are as deftly manipulated. The cost of making the pig is about \$32 per ton, and from this steel, worth \$75, a sum which allows the manufacturer a fair profit, comes in competition with the English production, for which \$95 is demanded on this side of the water.

The facts which we have mentioned will appear to many incomprehensible when the unsettled condition of labor in Troy for some time past is recalled. This state of affairs certainly renders the circumstances all the more remarkable, for that which has been done has been accomplished in the face of strikes, and during the prevalence of trade union intimidation, when reliable workmen were few and far between. In all the great works above mentioned, not a union man is employed. Abnegation of trade societies is a rigid condition upon those hired. As a result, skilled labor has had to be manufactured.

Brains and the green hands did what we have told; skilled labor found itself for once unable to overcome its employers as it did in Pittsburgh, and skilled labor, in the persons of the trades unions, went to the wall. Meanwhile the day laborers, the carpenters, the bakers, and who not, collected in the great plant, have, under the direction of enterprising capital, brought forth from its furnaces a production twenty per cent greater than ever before. Still better and greater, they have been the means of demonstrating to the nation that the days when the ships that float our commerce, when the mechanism which represents the highest of our inventive skill, and when the arms which protect us against our enemies, are but sources of profit to foreign hands are soon to be numbered with those for ever past.

The enterprise which has so successfully developed these resources, and the executive skill which has organized and governed the labor of this great undertaking, exhibit a power not only to emancipate the country from a foreign product, but also to free labor from the despotism of the trades unions.

CIMEX LECTULARIUS.

A correspondent, who states that he has perused with much gratification our recent article on the "Mission of the Fly," based upon Mr. Emerson's ingenious researches, sends us a pathetic epistle, in which in a few poetic, almost Miltonic, phrases he depicts dire nocturnal anguish; and then, lapsing into gross utilitarianism, he demands if we know any use for the bedbug. There is a vein of subtle sarcasm, we fear, underlying the request of our correspondent, or else he would not have made it; for the utility of that odoriferous insect as a stimulant to the invention of new expletives and of patent vermin eradicators is certainly unquestioned.

Still, and seriously, the writer seems to have unwittingly wandered into that same error in which nine out of ten of those whose motto is *cui bono* find themselves involved. It is an entire mistake to suppose the human race of such overweening importance in the scheme of creation that everything else is made for its benefit only. All things animate

and inanimate are undoubtedly created for some wise purpose, but that such is always to enure to the advantage of man by no means follows. There have been periods in the earth's history when nothing on the globe was of the slightest human utility: man could not even exist. Again, still later, the earth, though inhabited by living beings, was unfit for humanity, for the creatures which then flourished would speedily have exterminated it. Because, then, the human race now dwells and multiplies upon the globe, there is no reason to suppose that its enemies have utterly disappeared, any more than there is to warrant a like supposition regarding things hostile to any other living creature. That the number of enemies of man is constantly decreasing is true, and that some time they may altogether disappear is not without the bounds of imagination; but it nevertheless is just as plausible to believe that the great cave bears and other gigantic brutes which peopled the earth at man's advent did not attack him a whit less fiercely than *cimex* does now. In fact, we have no doubt that some troglodyte in the recesses of his cavern, or lake dweller perched on his pile-supported lacustrine habitation, has wondered of what earthly use cave bears, and wolves, and hyenas, and gigantic saurians were, with as much fervor as any modern individual has vexed his brain with the same thought after a night's combat with the minute pests.

Clearly, then, the attempted destruction of ourselves by the bugs is only one link in the chain which pervades all animated nature, and therefore it is with equal plausibility that it may be asked: of what use are we to the bedbug? as of what use the bedbug is to us. Our correspondent who describes the effect of the ravages of *cimex* so graphically certainly will require no answer to the former question.

We know nothing good of the bedbug; he has never found, so far as we can learn, but two defenders: one, an insane Englishman who made a pet of him, and left, on dying, to his disgusted heirs, a room swarming at every point; the other, a Banian hospital at Surat, India, in which a ward was devoted entirely to vermin, as other wards were to various kinds of animals. Forbes, in his "Oriental Memoirs," says: "The overseers of the hospital frequently hired beggars from the streets, for a stipulated sum, to pass a night with the fleas, lice, and bugs, on the express condition of suffering them to enjoy their feast without molestation."

It is said that bedbugs did not appear in England until after the great fire in London in 1666, and then they arrived in the wood imported from America for rebuilding the city. It is hardly necessary for us to suggest that the bedbug, being indigenous to our soil, offers a grand opportunity for the display of another great national resource at the Centennial. Specimens of *cimex*, as reared in different States, and perhaps a working model of a boarding-house bedstead, in which might be displayed the entire mode of raising the insects, would be of deep and lasting interest to foreign visitors. The fact of Pliny mentioning the bug several hundred years earlier than the time of the English writer, however, rather throws a doubt upon the assertions of the latter as to the origin of *cimex*. A variety of them certainly does infest pine woods—*ergo*, beware of pine furniture—and has been frequently found in the great forests of Sweden, and hence it is probable that in the pine lumber carried across the Atlantic whole colonies of the pest existed, which merely added to the stock already accumulated in Britain.

It is a curious fact that, in an old edition of the Scriptures known as Matthew's Bible, published in the middle of the last century, the passage translated in our modern version "thou shalt not be afraid of the terror by night" is rendered "thou shalt not nede be afraid of any bugs by night": a plausible translation in times when houses were so infested that two noblemen, after an attempt at rest in an inn, "were grievously frightened the next morning and sent for a leech, lest they were stricken with the plague."

Cimex, among other peculiar traits, hates horses and wages desperate war on fleas. He will not attack fowls, but will swallow and bats. Goetz has kept him six years without food, and he has withstood a temperature of 5° below zero, Fahr., without injury. The female deposits 250 eggs at a time, which require three weeks to hatch. Against these there is practically no remedy save mercury: heat, cold, moisture, and dryness being alike destitute of effect. The insect is possessed of keen sight and of an exquisite sense of smell, by the latter of which, and not (as popularly supposed) by the sensation of heat, it is guided to its prey.

The arch enemy of the bedbug is the *reduvius personatus*, a bug which rolls itself into a ball, covers itself with dirt, and then lies motionless in wait, pouncing on the unsuspecting *cimex* the moment the latter comes within reach, and sucking its carcass dry. The objection to training and rearing the *reduvius*, as a hunter of bedbugs, is that it bites the human race with much more spite than it does its natural prey.

Finally, the use of *cimex lectularius*—if he have any, beneficial to man—is simply to preach cleanliness; for where that is maintained, he finds no resting place.

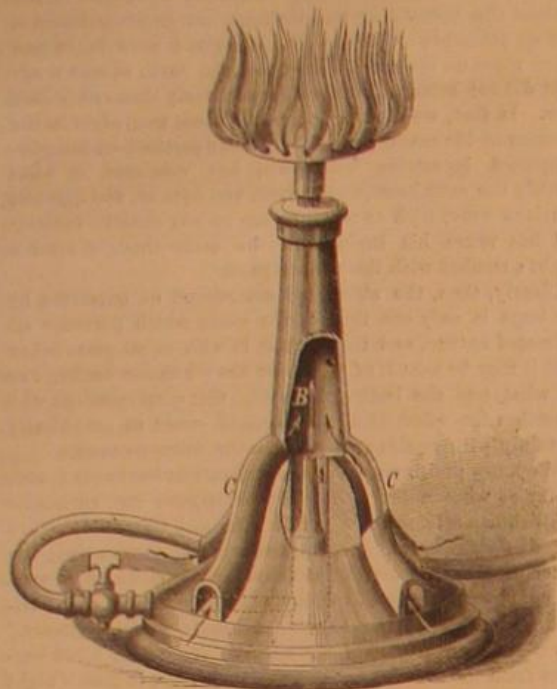
Robert Hardwicke, F.L.S.

Mr. Robert Hardwicke, founder and publisher of *Science Gossip*, a very excellent English periodical, devoted mainly to entomology, zoology, and botany, recently died of paralysis. Mr. Hardwicke is well known on both sides of the Atlantic as a zealous promoter of the cause of Science, which he has materially aided by the publication of its literature in cheap and popular form. He was an earnest advocate of the study of Nature as the greatest of all text books; and the main object of the journal, to which he devoted his best endeavors, was to inculcate like ideas among all students of Nature's works.

IMPROVED GAS BURNER FOR HEATING PURPOSES.

The accompanying engraving represents a new gas burner, designed for heating or cooking purposes, the novel feature in which is a chamber in the standard, in which the gas and air is mingled, the latter being drawn in by the ascending gas current. The object is to afford to the gas flame a more perfect supply of oxygen, and so to insure better combustion.

In the illustration, the gas is brought into the standard through the pipes indicated by the dotted lines and discharged at the nozzle, A, into the chamber, B. The air is drawn in through the channels, C, several of which are disposed about the lower portion of the standard and communi-



cate with the chamber. The burner, the tube of which leads from the compartment last mentioned, is of any desired form.

Patent pending through the Scientific American Patent Agency. For further particulars address the inventor, Mr. Anatole Ehret, No. 540 Washington street, San Francisco, Cal.

SCIENTIFIC AND PRACTICAL INFORMATION.**A NEW RAILWAY GAS LIGHT REGULATOR.**

In the trains of the London and Northwestern Railway, in England, gas made from oil has been substituted for that obtained from coal, the former containing more carbon, weights being equal, and burning longer. Each carriage carries under its flooring its own reservoir, into which the gas is compressed to six atmospheres' pressure. From the reservoir, a copper tube leads to the regulator, which consists of a cast iron box closed by an impermeable membrane which connects by a rod with a valve. When the latter is open, the gas enters the regulator; and when the regulator is full, the membrane swells and shuts the valve. It is said that the mechanism governs the flame perfectly, keeping it equal even during the movement of the train.

THE FAUNA OF THE MEDITERRANEAN.

A series of deep sea dredgings are soon to be undertaken on the Mediterranean bottom, the results of which it is expected will add greatly to the numbers and natures of the submarine zoöphytes now known. An annelid which has hitherto been believed to be peculiar to the Spitzbergen seas alone was recently discovered on the French coast.

VEGETABLE WAX.

The result of a series of investigations, recently concluded by M. de Bary, upon the subject of vegetable wax, shows that the material is a secretion of the epidermis of the plant in which it is elaborated. This is a confirmation of the theory, held by old writers but denied by more modern histologists. The wax is fusible at above 212° Fah., combustible, lighter than water and insoluble therein, but is soluble in boiling alcohol.

EARTHQUAKE INVESTIGATIONS.

Father Bertelli, an Italian monk, for several years past has made a study of the tremblings of the earth, and more especially those which are so extremely slight as not to be perceptible, save by pendulums placed in the fields of microscopes. In one year, he recognized 5,500 of the movements; and graphically representing the same over many years by a curve, he finds that the line corresponds neither with the thermometric curve nor with the tidal phenomena, nor can it be brought into any relation with the distances or positions of the sun or moon. With the barometric curve, however, it is otherwise; and it appears that, in the large majority of cases, the intensity of the movements augmented with the lowering of the barometric column as if (as the investigator states) the gaseous masses imprisoned in the superficial layers of the earth escaped more easily when the weight of the atmosphere diminished.

A FATAL BALLOON ASCENT.

The Zenith, a balloon belonging to several eminent French aeronauts, Messrs. Tissandier, Spinelli, Sivel, and others, recently (says a cable dispatch) ascended to a height of 26,000 feet. Two out of the three persons in the car were killed by

suffocation, and the third reached the earth in a condition of serious and probably mortal illness. No names of the victims are given; and it is to be hoped that those of none of the above-named eminent gentlemen have been added to the long roll of the martyrs of Science.

THE MISSISSIPPI DELTA IMPROVEMENT.

Captain Eads has, we are informed, closed a contract with Colonel James Andrews, of Allegheny City, Pa., for the construction of 350,000 cubic yards of fascine work, and 100,000 cubic yards of stone work, at South Pass, together with a large amount of timber work, piles, etc., for the Mississippi river enterprise described in our last issue. Colonel Andrews is to furnish his own outfit for this work, and put in place 60,000 yards of fascines, piles, etc., before requiring any pay. His contract will amount to \$2,500,000. Colonel Andrews built the masonry work of the great bridge at St. Louis. He visited Europe last summer with Captain Eads, and carefully studied the jetty works there. He will begin providing his equipments as soon as \$300,000 is subscribed by the South Pass Jetty Company, which has been organized in St. Louis. The government is to pay \$5,250,000 for the work when completed and a minimum of 30 feet of water obtained.

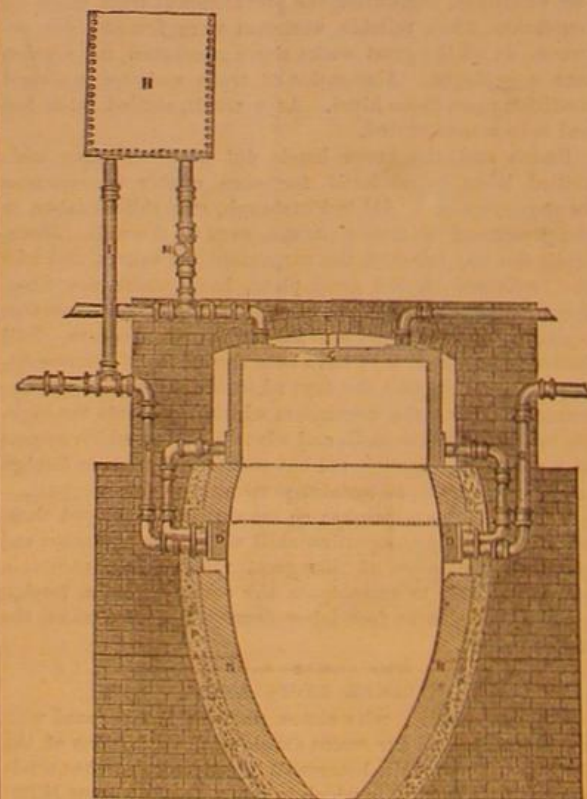
New Mode of Burial.

A new idea for the disposition of the dead has recently been broached in Paris, by a lady, Mlle. Jaloureau, which is both simple and practical, and certainly appears to offer a means of avoiding the deleterious results ascribed to the presence of cemeteries, while allowing of the retention of those, by most people, hallowed resting places. The objects sought were, first, a coffin which should closely confine all noxious exhalations, and second, a means of hastening decomposition while preventing putrid fermentation. These desiderata, it is said, are effectually obtained, the first by coating the interior of the receptacle with bitumen or asphalt, and the second, by placing with the body a quantity of phosphate of lime. The editor of *Les Mondes*, in describing this invention, asserts that corpses thus enclosed may be kept for years without alteration, save in the mummification of the bodies, and he adds that the process is virtually the same as that of the Chinese and the ancient Hebrews.

HEATING BUILDINGS WITH HOT WATER.

We illustrate, in the annexed engraving, a system of utilizing waste heat, by which water can be raised to a high temperature and conveyed to a distance, there to be used in heating buildings, etc. It is the invention of Mr. Cowan, a Scotchman, and it attracted much attention at the Manchester Exhibition in 1873. It has been largely used in Europe for hot house and greenhouse purposes.

In our engraving, the invention is shown in section, in combination with a lime kiln, but the system can be adapted to a great variety of circumstances. L is an egg shaped kiln chamber, which may be made eight or nine feet in depth; C is the main boiler, occupying the position of a cover to the kiln; D is an annular boiler, communicating with the boiler, C, through the pipes, F; G G are the return mains, completing the circulation, for the return of cooled water to the boilers, and also for keeping open communication with the expansion cistern, H; and this cistern, H, also acts as a safe-



ty valve to the whole apparatus, and is therefore indispensable. The condensed water from the cistern, H, is returned to the annular boiler, D, through the perpendicular pipe, I; M is a valve in the flow pipe to the expansion cistern, H; and the pipes, E, communicate with all the premises to be warmed, and through valve, M, with compensating cistern, H. A blow-off cock for the annular boiler is necessary.

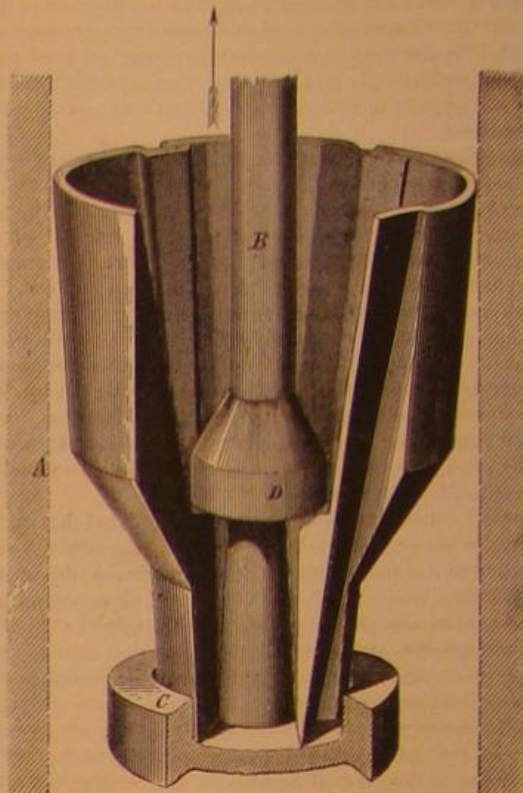
A complete circulation, through pipes of great length, is claimed for this apparatus, which can be erected anywhere outside of the buildings to be heated. In the extensive hot-houses at Hatfield Park, England, 7,000 feet of four inch pipe are heated in this way; and one gentleman uses the furnace or kiln for the manufacture of coal gas for his own consump-

tion, obtaining gas, coke, and heat for his forcing house at a very moderate expense.

IMPROVED SECTIONAL PUMP BUCKET.

The sections of which this bucket are composed are so constructed that they pack tightly together when the bucket is raised, and loosen or contract when the same is lowered. The appliance is made entirely of metal, and without pins, screws, or bolt.

A, in the annexed illustration, is the barrel of the pump



and B, the plunger rod. The bucket is formed of sections, as shown, the lower portions of which rest in the cup, C. A broad collar, D, on the plunger rod, forms the bottom of the bucket, the sections closing tightly around it, while also lapping on each other so as to break joints. The bucket is brought to an edge at the top, and when raising water it expands against the barrel and remains tight. When descending it partially collapses, and so is lowered, without friction against the barrel. The bucket may be made of any size to hold more or less water.

Patented through the Scientific American Patent Agency, March 16, 1875, to Mr. Geo. W. Burr, of East Line, N. Y., who may be addressed for further particulars.

A New Water Gas Enterprise.

We are enabled to announce to our readers that the manufacture of gas through the decomposition of steam by incandescent carbon, according to patented methods of M. Tessié du Motay, of France, is about to be carried on, on a large working scale, in this city.

The company is known as the Municipal Oxygen Gas Company, and is under the presidency of R. M. C. Graham, Esq. Their works are located in 41st. street, between Tenth and Eleventh avenues. They have decided to erect furnaces at once, and to lay mains for the manufacture and distribution of from four to five hundred thousand feet of this gas, enriched with naphtha, for illuminating purposes. The cost of the production, in this way, of a gas of good calorific power, we have every reason to believe, from information in our possession, will be very low indeed; and the prospect seems good, therefore, that gas may soon be furnished in New York city for warming houses and cooking food, as well as for many manufacturing uses, cheaply enough to inaugurate a new era of civilization—an era which we have long hoped for and looked forward to.—*American Gas Light Journal*.

John Harper.

John Harper, the elder of the two survivors of the four Harper Brothers, who founded the celebrated firm of that name, died at his residence in New York on April 22. He was born in 1796, and was the grandson of an Englishman, an early disciple of John Wesley, who came to this country about 120 years ago. With one of his brothers, he opened a small printing office in Dover street, in this city, in 1817. The two other brothers subsequently joined them; and by their joint endeavors, and their perseverance and integrity, the vast business now owned by the firm was steadily and quickly built up. Mr. Fletcher Harper is now the sole survivor of the original firm; but the sons of the seniors are accomplished business men, and there is no fear but that the house will be carried on in a manner to sustain its reputation.

A BELLIGERENT PROFESSOR.—Señor Varela, Professor of Physiology in the Medical School at Barcelona, Spain, was recently annoyed by hissing and other disturbances among the students, whereupon he drew a loaded revolver and threatened to fire on the class. A general stampede took place, in the midst of which the rector seized and disarmed the warlike teacher, and conducted him off the scene.—*Medical Journal*.

ACCORDING to the *Journal des Chemins de Fer* of Constantinople, the total length of all the railroad lines in the world is 123,462 miles, and their cost, \$11,355,100,000.

THE NEW GOLD FIELDS.

No expedition since the war, says the *Science Record* for 1875, has attracted more attention or excited more interest than the one which left Fort Abraham Lincoln, Dakota, on the 2d of July, 1874, to explore the Black Hills. This region of country, lying in the southwestern part of Dakota, and extending some distance into Wyoming, and slightly indenting Montana, has, until now, in its interior, been entirely unexplored by the white man. Previous expeditions have skirted the hills, but never penetrated them, and we have been dependent on the reports and traditions of the Indians for the little we have known of them. The hostility of the Indians has defeated any attempts to explore the country by civilian parties.

The present expedition was entirely a military one, and consisted of ten companies of the 7th cavalry, two companies of infantry, and three pieces of artillery, in all about 700 soldiers, with the addition of a train of 120 wagons, and about as many teamsters, the whole under command of Major General George A. Custer. The scientific corps consisted of Colonel William Ludlow, U.S. Engineer Corps; W. H. Wood, assistant; Professor N. H. Winchell, geologist; Professor N. H. Winchell, geologist; Professor A. B. Donaldson, assistant; George B. Grinnell, paleontologist; L. H. North, assistant; Dr. J. W. Williams, chief medical officer, botanist.

The expedition reached the Black Hills about the 20th of July, after a march of eighteen days, mostly over an arid, treeless, desert country. General Custer, in spite of the prophecies of his Indian guides, who declared the thing impossible, succeeded in penetrating to the very interior of the hills with his wagon train; and by sending off detachments of cavalry here and there, has succeeded in exploring and mapping the hills through their entire length and breadth. The country is found to be of great scenic beauty, as shown by our illustration, and is luxuriant in vegetation, abundant in game, timber, and good water. Thousands of acres of fertile land invite settlement. The country, however, is a part of the Sioux reservation, and cannot be opened to the whites until the government shall make some satisfactory arrangement with the Indians.

On the 31st of July gold was discovered along the banks of a creek, on which the expedition was encamped, the best pans yielding from five to ten cents' worth of gold, equivalent to fifty dollars a day to the man, if the yield should prove as good as promised.

Our camp view of the principal park in the hills gives some idea of the size of the expedition. This site was selected for the permanent camp, and from this point detachments radiated for several days.

Many expeditions to this region have been organized, and numerous persons have been induced to deposit small sums of money for outfit, fees, preliminary expenses, etc. It should, however, be known that the military authorities will maintain the rights of the Sioux Indians, and will prevent any attempt, on the part of white men, to commence mining operations within their territory. The specious advertisements for miners and adventurers to start immediately to the Black Hills gold fields should therefore be avoided.

IMPROVED SAFETY VALVE.

Our engraving shows a new form of safety valve for marine use, from which the steam is led away and blown into the sea without any increase of pressure being necessary. It is the invention of Messrs. D. Cockburn & Son, of Port Eglinton, near Glasgow, Scotland, and three forms of it are shown in the illustration (for which we are indebted to *Engineering*); but a description of Figs. 1 and 2 will serve to explain the whole. This valve, which is $1\frac{1}{8}$ inches in diameter, was applied to the boiler of the steam yacht Griffin, this boiler being worked at 60 lbs. pressure, and having three furnaces containing 50 square feet of fire grate area. The steam escaping through the valve was not discharged freely into the atmosphere, but was led down through a pipe and discharged through the vessel's side below the water line.

Notwithstanding this arrangement of the discharge, and the large fire grate area, this valve was found capable of preventing any accumulation of steam pressure beyond that to which it was loaded. The manner in which this result is obtained is as follows: Referring to Fig. 1, it will be seen that the safety valve proper, B B, is an ordinary valve with feather guides and bearing upon a narrow flat seat. Below the flange carrying the seat of the valve is formed a chamber, C, and the feathers of the valve are prolonged down-

wards so as to carry a disk, A A, which nearly fits an opening formed in the bottom of the chamber, C. The result of this arrangement is that, on its way to escape through the valve when the latter is lifted, the steam has to pass through the narrow annular space, O O, and in doing so, it becomes wire-drawn, causing the pressure in the chamber, C, to be less than the boiler pressure. The upper side of the disk, A, is thus, as soon as the valve opens, exposed to a less pressure than the lower side, and thus the valve, as it lifts, is assisted in opening by the excess of pressure on the under side of the disk, A.

The disk, A, has a thickness equal to the lift of the valve, and its periphery is turned to such a form as to increase the annular area, O O, as the valve rises, the ratio of this in-



THE NEW GOLD REGIONS.—BLACK HILLS.

crease varying according to the way the valve is loaded. In the case of the valve fitted to the Griffin, the bottom disk was originally made as shown at D, Fig. 2; but this form, although suitable for a spring-loaded valve discharging into the atmosphere, was found not to give sufficient lifting power to overcome the resistance of the water in the case of the discharge below the water line. In this latter case it was found that, when the valve commenced to rise, a good deal of power was required to set in motion the water in the pipe, and hence a disk was applied having the edge formed as shown at E E, Fig. 1. This form was found to answer perfectly, as we have already stated. While speaking of this silent discharge, we may mention also that it was found necessary to fit to the pipe an air valve opening inwards to prevent the waste steam pipe, etc., from being filled with water when the blowing-off of the steam ceased.

Of the remaining figures, Fig. 3 shows one of these valves loaded with dead weight, and in this case it will be seen a

Sleep, and How to Procure It.

We read of Bismarck that "his old foe insomnia still tenaciously clings to him. He passes whole nights waking. At morning dawn, slumber, if not sleep, comes at last, but the day finds him weary and unfit for work, yet with mountains of work to get through." Having paid considerable attention to this important question of being able to procure sleep, I venture to record what I know about it.

The human frame cannot do without sleep. I believe the reason is that the mysterious property—for want of a better name we call it "vital energy"—gradually leaks out during the day. During sleep, the machinery of the body, especially the brain, becomes recharged with it. The cause of not being able to sleep—I write now of people in good health and hard workers with their brains—is that the brain cannot, so to speak, "go down," but it continues to act, more or less. My father, when writing the *Bridge-water Treatise*, had his own way of working. He was an excessively busy man during the day, and had only the night hours in which he could write. He generally dined at seven o'clock, and immediately after dinner went to sleep for two or three hours. He then got up, and worked on till two or three in the morning. Just before retiring to rest, he took some light pudding, or a sandwich, with cocoa or milk. Thus he always slept well, as the blood was diverted from the brain to the stomach.

I have no hesitation in saying that the proper thing to do is to go to sleep immediately (or at least very soon) after the meal of the day. All animals always go to sleep, if they are not disturbed, after eating. This is especially noticeable in dogs; and the great John Hunter showed by an experiment that digestion went on during sleep more than when the animal was awake and going about. This is his experiment: He took two dogs and gave them both the same quantity of food. One of them was then allowed to go to sleep, the other was taken out hunting. At the end of three or four hours he killed both these dogs. The food in the stomach of the dog which had been asleep was quite digested; in that of the one which had been hunting the food was not digested at all.

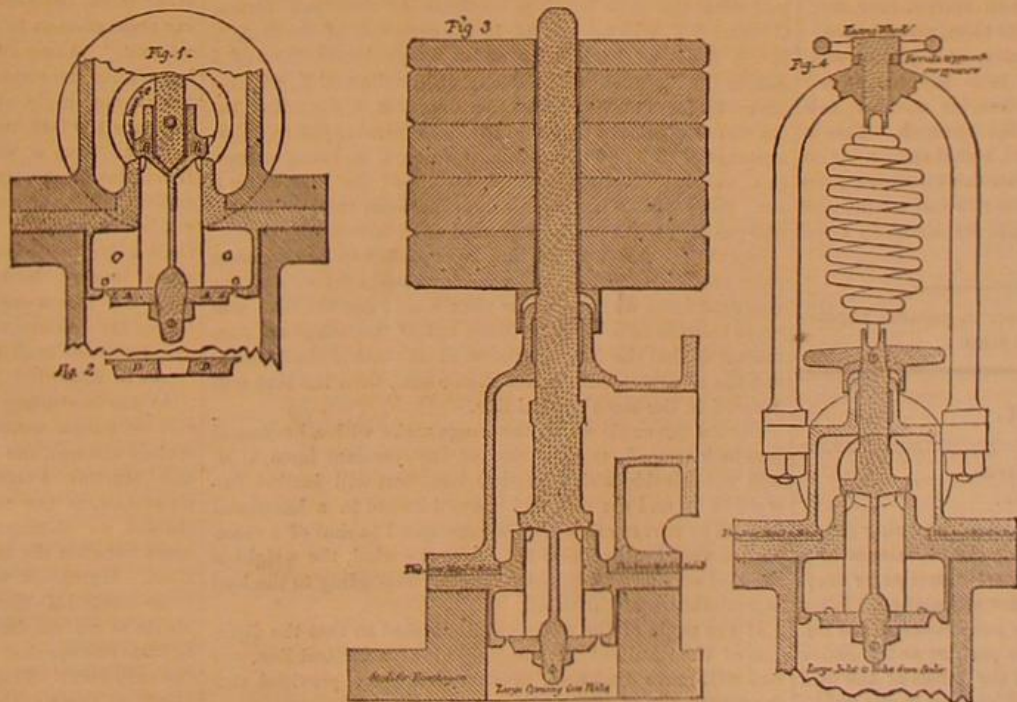
This fact, I think, shows the advisability of going to sleep immediately after eating. This ignored fact always occurs to my memory when I see old gentlemen nodding over their wine. Nature says to them: "Go to bed." They will not go to bed, but still Nature will not allow her law to be broken, so she sends them to sleep sitting in the chairs. People therefore who feel sleepy after dinner ought to dine late, and go straight to bed when a sleepy feeling comes over them.

Most good folks, however, do the worst possible thing imaginable; they retire altogether into the drawing room, and then to make matters worse, they drink tea and coffee. Now I regard tea and coffee when taken at night to be poison to certain constitutions. It is very well in the morning, but it is very bad at night. The reason why tea and coffee should not be taken at night is that the one contains an alkaloid called theine, and the other contains an alkaloid called caffeine. These two alkaloids taken into the system stimulate the brain and do not allow it to go to rest. I speak of this matter from experience. If I take thoughtlessly a cup of tea or coffee after five o'clock in the evening, going to bed about eleven, I cannot go to sleep; and if the brain does fall asleep, the alkaloid will wake it up in about an hour or two. Sleeplessness, therefore, is usually caused by tea or coffee, though strange to say that tea and coffee actually send some people

into sound slumber.

I well recollect the late Dr. Wilberforce, then Bishop of Oxford, telling my father, then most actively engaged as Dean of Westminster, of his patent way of going to sleep. It is better than the old-fashioned prescription of watching sheep jumping through a hedge one after another, ships sailing out to sea, etc. The Bishop's prescription was to repeat very slowly the vowels A E I O. In doing this, they were to be faintly pronounced with each inspiration and expiration. It will be found easy to do this without moving the lips, but the vowel U must not be pronounced, for to do this the muscular action of the lips necessarily takes place, and sleep comes not. I advise my readers to try this plan.

I once heard of a midshipman who complained that he could not sleep at night because there were no waves dashing against the sides of the ship. To this noise he had so many months been accustomed that he could not sleep without the familiar sound. He asked his mother to dash pails of



COCKBURN'S EQUILIBRIUM SAFETY VALVE.

different form of relieving disk is employed; while Fig. 4 shows a spring-loaded valve. Of course other modifications can be arranged to suit various circumstances. Altogether the valve is a very simple one, and it appears in the recent trials to have shown an efficiency which entitles it to special attention.

BRITISH iron rails have ceased for the time to be an article of American consumption. About \$6,500,000 worth of British rails were imported in 1874, but they were all, or nearly all, steel. The change is very great and sudden, for in 1872 our imports of British rails amounted to \$24,000,000, and in 1873, to \$12,000,000. Notwithstanding the great fall in iron since 1872, the decrease in quantities is no greater than that in values, which is owing to the fact that last year we imported only steel rails, which will last a great many years, while in 1872 we imported the cheapest and poorest iron to be found in England.

water against his bedroom door till he went to sleep. I was once told, when on a salmon inspection, that a certain miller could sleep so long as the continued whirr of the mill wheel was going on, but directly the noise stopped he awoke.

The deepest sleep is always just before dawn. It is, I believe, probable that some change takes place at this time in the atmospheric condition, as the hour just before dawn is selected by savages to make their attack, and it is at this time also, I believe, that a great proportion of children are born. When staying at a country house, unfortunately, the visitor not accustomed to country sounds gets often woke up. The abominable cocks begin their horrible crowing, called, in Herefordshire, "cock shoot." I recollect on one occasion, after the wretched cocks had gone from the fowl house to feed, I fell asleep, and then there came a most awful cry of agony; in fact, the farmer killed a pig under my window—enough to wake anybody. This pig was most vociferous, but as he was immolated in honor of my arrival, I could not say much.

My monkeys always get sleepy when the gas is lighted in my study, where I and my monkeys always sit. This room was once called by the servants the "Master's room"; but I found out lately, by accident, that they now call it the "Monkey's room." This is Darwin going backwards!

Dogs, likewise, will sleep at night if they can; cats, I observe, are sleepy in the morning, the reason being that the wretches have been out all night, and, of course, feel very seedy in the morning, and doubtless their heads ache sometimes; and it serves them right if they did, considering the row they make, fighting and caterwauling! I have strong reasons to think that my own black cat is president of a free and easy club, for they hold their meetings among the ruins of the Colosseum at the back of my house. This a regular "cattery." All the stray cats in the Regent's Park and the neighborhood come here to arrange family matters; sometimes they come into a back cellar where I keep skeletons, casts, etc., and kindly supply me with a fine lot of kittens, which I convert into skeletons, casts, etc. I confess I do not know how to get rid of caterwauling cats. Will any one tell us?

I now venture to suggest a new but simple remedy for want of sleep. Opiates in any form, even the *liquor opii sedat.*, and chlorodyne, will leave traces of their influence the next morning. I therefore prescribe for myself—and have frequently done so for others—onions: simply common onions raw, but Spanish onions stewed will do. Everybody knows the taste of onions; this is due to a peculiar essential oil contained in this most valuable and healthy root. This oil has, I am sure, highly soporific powers. In my own case they never fail. If I am much pressed with work, and feel I shall not sleep, I eat two or three small onions, and the effect is magical. Onions are also excellent things to eat when much exposed to intense cold. Mr. Parnaby, Troutdale Fishery, Keswick, informs me that, when collecting salmon and trout eggs in the winter, he finds that common raw onions enable him and his men to bear the ice and cold of the semi-frozen water much better than spirits, beer, etc. The Arctic expedition, just now about to start, should therefore take a good stock of onions. Finally, if a person cannot sleep, it is because the blood is in his brain, not in his stomach; the remedy, therefore, is obvious: call the blood down from the brain to the stomach. This is to be done by eating a biscuit, a hard boiled egg, a bit of bread and cheese, or something. Follow this up with a glass of wine or milk, or even water, and you will fall asleep, and will, I trust, bless the name of—*Frank Buckland, in Land and Water.*

ANILINE colors can be used to impart to paraffin candles most beautiful red, purple, and violet tints.

Correspondence.

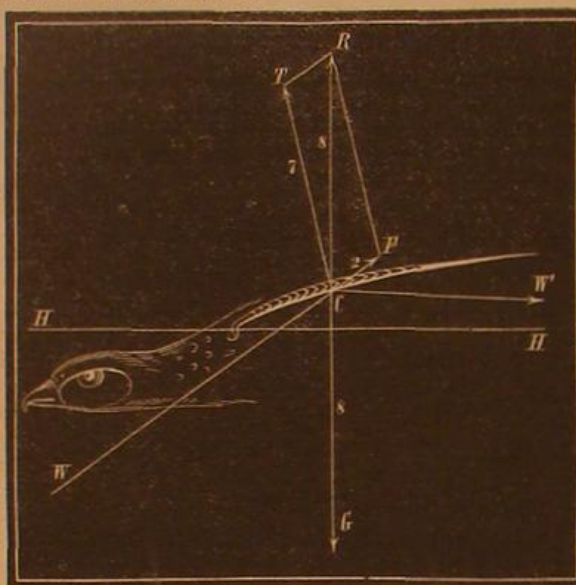
The Flight of Birds.

To the Editor of the Scientific American:

The ability (possessed by some birds) of hovering or remaining fixed over a given point during the prevalence of a breeze, and that, too, without any apparent motion or exertion, has ever been a fruitful theme for speculation. Some regard it as a phenomenon beyond the penetration of the human mind, while others refer it to the positive and negative forces of electricity, to the fact that the bones of the bird are hollow, or to some other cause. The most recent publication pertaining to this subject is an elaborate work by J. B. Pettigrew, M. D., who has long been regarded as an authority in the old world. Though one hundred pages are devoted to "progression through the air," I think only one reference is made to the subject of hovering. On page 115, he informs us that the hawk, when hovering, sustains his body "by the action of his wings." But the *modus operandi* and mechanical principles involved are not explained. Neither is it possible to deduce them from the results of any of his experiments. It is to be regretted that the learned gentleman was not a little more explicit on a point that is quite as remarkable as anything relating to the subject of which he treats.

I submit a solution on simple mechanical principles, which illustrates not only how a bird may remain fixed in a current of air, but explains other equally well known facts, namely, how it can rise or fall in a vertical line, or move ahead or back, to the right or left, in a horizontal line, and that, too, without the expenditure of muscular force other than may be necessary to keep its body poised in a proper position. It

is based on the fact that the course of the wind over the surface of the earth is not always horizontal, but sometimes inclined upward. That becomes evident when we reflect that winds are caused, primarily, by unusual heat in the air in a given locality, causing it to rise, and giving the surrounding air a tendency to rush in to fill up the space, the same cause imparting both an onward and an upward movement. This may be illustrated on a small scale by a burning gas jet, which heats the air, causing it to rise. If the air in the room be permeated with smoke, or any substance by which its motion can be discerned, it can be seen that, as the air rushes in to feed the flame, the smoke moves with an upward inclination. If this be not true of winds (under some circumstances at least), how is it possible to account for sand being carried by wind into a second story window, or the cinders of a volcano 1,000 miles out to sea, or a stick of timber, one foot square and twenty feet long, being raised from the ground and carried a long distance through the air during the passage of a tornado? These results could not be produced by horizontal air currents. With this understood, we have but to apply the law relating to the parallelogram of forces in order to comprehend the annexed sketch, illustrating various mysterious movements in the flight of birds. H H' represents a horizontal line, C G a vertical line, and C the centers of gravity and of resistance, which coincide. W C represents the direction in which the wind is blowing, and C W', the direction in which it is reflected from the under surface of the bird's wing. The resulting pressure or thrust of the wing will be at right angles to its surface, or in the direction of the line, C T.



Another force is brought to bear on the bird. It is the force of the wind against its body, and is exerted in the direction of the line, C F. This force we will suppose to be to the thrust of the wings as 2 to 7; yet it is not essential just what the ratio is. The resultant of these two forces, C F and C T, will be exerted in the direction of the line, C R. If the wind be blowing so as to produce a force of 2 ozs. in the direction of the line, C F, the line, C T, will represent a force of 7 ozs., and the line, C R, 8 ozs., that being the comparative length of the lines forming the parallelogram, C F R T. This resultant force, C R, being exerted in a vertical direction, and the weight of the bird being 8 ozs., there will be an equilibrium between the two forces, and the bird will remain suspended as in hovering.

Should the wings of the bird be expanded so as to present more surface, or should the wind increase in force, then the resultant force will be greater than 8 ozs., and the bird will move upward in a vertical line; but if the wings are contracted so that the force of the wind on them is diminished, and the resultant force is less than 8 ozs., then the bird will descend in the same vertical line.

Should the angle which the wings make with a horizontal line be increased, the direction of the resultant force, C R, will not coincide with a vertical line, but will incline forward of it, and the bird will move forward in a horizontal line. The movement will then correspond to that of a close-hauled vessel sailing near the eye of the wind, the weight of the bird serving as a fulcrum, and corresponding to the keel or centerboard of the vessel.

If the angle of the wings be diminished so that the direction of the resultant force inclines aft of a vertical line, the bird will move backward in a vertical line, provided that the magnitude of the resultant force be 8 ozs.

If the body and wings of the bird be careened to the right, so that the direction of the resultant force inclines to the right of a vertical line, the bird will move to the right in a horizontal line; but if the bird be careened to the left, then the motion will be reversed. It will be seen from the above that the movement is dependent on two conditions, namely, the ability of the bird to control the amount of the resultant force by increasing or diminishing the expanse of its wings, enabling it to rise and fall in a vertical line, and, secondly, its ability to control the direction of the resultant force by altering the inclination of its wings, whereby it is enabled to move to any point of the compass in a horizontal line. By a proper combination of these conditions, an infinite variety of evolutions and manœuvres can be performed, but an explanation of these is more complicated.

The sketch is not intended to be in proportion or to represent positions accurately, but only the general application of principles.

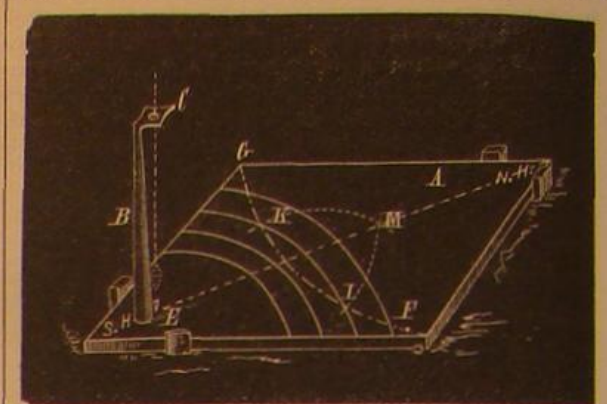
Bridgeport, Conn.

F. G. FOWLER.

Finding the Meridian.

To the Editor of the Scientific American:

I have used for the above named purpose, while surveying the experimental line for the original Pacific Railroad thirty years ago, a simple expedient, of which I send you a sketch. A is a board about two feet square, placed level on the ground and secured by pegs; near the southerly corner a



staff, B, is raised perpendicularly. On the top of B is placed in a slit a piece of tin, C, having a small hole in it; this tin is placed nearly at right angles with the rays of the sun at noon. A plumb line is passed through the hole in the tin, and the point, E, is marked. From this as a center, a number of concentric lines are marked on the board. Towards noon, the sun's rays, passing through the hole in the tin, C, will pass over the board from F to G, as shown by the dotted line. If, before noon, the point be marked where the shadow crosses one of the concentric lines, say at I, and again where it passes the same line after noon, at K, and if a perpendicular be raised from the points, K and I, at M, then a line drawn from E through M gives the correct meridian.

Thus any person can lay out the true meridian; and the variation of the compass from the true north can be ascertained with the greatest nicety, a point of the highest importance to surveyors, as the variation of the needle is, in most places in our western States, an uncertain quantity.

JOSEPH A. MILLER.

(For the Scientific American.)

THE PALMS OF THE AMAZONS.

BY PROFESSOR JAMES ORTON.

Palms, bananas, and ferns are the three forms of special beauty peculiar to a tropical forest. Of these, the first give the most striking, as well as the most graceful, feature to the landscape. The elegance of the tall, slender stem, rough with the scars of fallen leaves, but branchless and symmetrical as a column, and the luxuriance of the feathery or fan-like foliage tossed out of the summit, compel admiration which no amount of familiarity tends to diminish.

It is usually supposed that the palms tower over all the other trees, their crowns standing so far above the surrounding vegetation as to give Humboldt's idea of "a forest above a forest." Along the sea coast and river banks, this is true; but within the virgin forest, the loftiest palms rarely exceed the average height of the exogenous trees. The highest may measure 130 feet, while the Brazil nut tree stands 200 feet.

Palms have a wonderful development of the organs of fructification, a single individual bearing half a million of flowers. Yet the number of trees representing a species is not in proportion. This is mainly due to the fact that the fruit is frequently aborted, or forms the food of hosts of animals, insects, birds, and mammals. Even man depends upon the palms for many important products—wood and leaves for habitations, bark and leaves for cloth and cordage, buds and fruit for food. The Indians call the miriti the "tree of life."

At the beginning of this century, only twenty-three species of palms were known to the scientific world. Now, mainly through the labors of Humboldt and Bonpland, Spix and Martins, Poeppig, Wallace, Spruce, Wendland, and Griesbach, in the new world, and of Blume and Griffith in the old, we distinguish nearly 600 species. These belt the earth between the latitudes of New Zealand and South Carolina. Humboldt was right in calling South America the most beautiful portion of the palm world. Certainly it yields to no continent in exuberance and variety. Europe has but one species, and Africa comparatively few; India is the only rival. There are 273 American forms, and probably 75 of these are peculiar to the Amazonas.

Palms have small power of migration; and it does not appear that any species is able to cross the ocean without the aid of man. They are distributed between the sea shore and the altitude of 11,000 feet. A few species range from the roots of the Andes across the whole plain to the Atlantic; but many are restricted to certain tributaries—to the Lower Amazonas, the Solimoes, or the Marañon. Palms are far more abundant on the east than on the west side of the Andes, and the species are entirely distinct.

The following are the most important palms observed in ascending the Amazonas and its chief affluents. The first two are fan-leaved; all the rest have feathery leaves.

Miriti, so called in Brazil, the Achual of Peruvians, the *Mauritia fluviana* of science, is the most universally distributed palm in the valley, abounding from the shores of the Atlantic to the altitude of 3,000 feet on the Andes of Peru, Ecuador, and New Granada. It is distinguished from all others by having both fan-shaped leaves and scaly fruits. It is a social palm, forming groves along the low shores at the mouths of tributaries and about swampy lakes. It is always

a conspicuous object, the smooth stem often rising one hundred feet, and bearing enormous spreading leaves and clusters of egg-shaped, reddish fruit, resembling pine cones. The epidermis of the leaves furnishes a useful fiber, the orange pulp of the fruit is eaten by the Indians or made into wine, and the farinaceous pith yields a kind of sago.

Bombonáje, or *Carludovica palmata*, the young, unexpanded leaves of which are so largely used at Moyobamba and Guayaquil in the manufacture of Panama hats, is called a palm, but is more properly a screw pine. It has no stem; the leaves are long, slender petioles, springing from the ground. The leaves are about two feet long, fan-shaped and four-parted, each segment being again ten-cleft; so that when folded in venation, each segment on its own rib, there are eighty layers in a young leaf. It occurs only on the slopes of the Andes. (See engraving on this page.)

Assaf, or *Euterpe dieracea*, is very common, and is the first palm, after the mirití, which arrests the attention of the traveler. Its tall, straight, slender stem, rising from 75 to 100 feet, its curious cabbage top (a long cylindrical leaf sheath), and its arched, plume-like foliage, eight or nine feet long, trembling in the gentlest breeze, give a peculiarly picturesque feature to the views on the Lower Amazons. Its leaves consist of 78 pairs of leaflets. The tree grows on moist soils from Pará to Tefé.

Paxiúba of Brazilians, the huacra-pona of Peruvians, and the *iriarte exorrhiza* of botanists, is equally abundant at the mouth of the great river and in the moist valleys of the Andes. It is easily recognized by its buttressed stem, that is, supported on a cone of emerged prickly roots resembling the spokes of a half opened umbrella, so that the tree looks as if standing on stilts. It is about forty feet high. (See engraving on page 354, vol. XXIX.)

Barrigüda, called tarapoto in Peru, is the *irearte ventricosa*. It is distinguished from all other palms by a curious swelling midway up its trunk. It is a solitary palm, rising from 60 to 100 feet. It is also buttressed, the cone of roots sometimes standing twelve feet high. The leaves, usually six in number, are eighteen feet long. It grows on lands not inundated, and ranges from the Rio Negro to 5,000 feet on the Andes.

Piassaba is a species of *Leopoldinia*, which furnishes the valuable piassaba of commerce, exported to England for the manufacture of brooms and brushes, but used on the Amazons for cables, for which it is admirably fitted, being durable and light, not sinking in water. The fiber in young plants is nearly five feet long, in old trees not two. The tree is about thirty feet high, and bears thick, large leaves fifteen feet long, with sixty pairs of leaflets. The stem is stout, and covered with a pendulous, brown, hairy beard, which is the fiber used. It is found only far up the Rio Negro.

Bussú, or *monocaria saccifera*, common about the mouth of the Amazons, looks at a distance like a rigid plantain, bearing immense, stiff, simple leaves, of a pale green color, and twenty-five feet long by six feet wide. The stem is not over twelve feet high.

Baccaba, or *anacarpus distichus*, is a stately, elegant tree, sixty feet high, with a straight, smooth stem, and a flattened crown of a dark green color. The leaflets are numerous and strongly plicate. The large bunches of oily fruit, weighing thirty pounds, are used, like those of the assaf, in making a beverage. The baccaba grows on the Brazilian Amazons. Another species, called pataná, is a giant among the palms, standing from 80 to 100 feet, with leaves nearly half that length. The veins of the leaves furnish the Indians with the needle arrows for their blow guns.

Jupatí, or *raphia tadigera*, is famous for its long, shaggy leaves, which measure from forty to fifty feet. It is the only fruited palm in America that has pinnate leaves. It belongs to the lower part of the Amazons.

Pupúha, or peach palm, *bactris gasipalis*, is one of the most beautiful and useful of palms, growing generally in clusters from sixty to ninety feet high, and thickly armed with prickles. Its numerous, curling, drooping leaves, seven feet long, have from sixty to seventy pairs of leaflets pointing in all directions. Under the deep green vault hangs the huge cluster of fruit, yellow and red when ripe, about seventy-five in number, and making a load for a strong man. It is nowhere found wild, although an undoubted native, but is seen in cultivated spots along the whole river. The Peruvians call it pisho-guayo. Many other species of *bactris* occur, but they are all dwarf palms, and form a considerable portion of the undergrowth in recent forests.

Tucúm of Brazilians, cambira of Peruvians, is the *astrocaryum vulgare*, a common forest palm, with a stout trunk from fifty to sixty feet high. The closely set leaves stand erect, broom-like, at the head of the stem. From the cuticle of the fronds are made the strongest mats, hammocks, nets, and twine on the Amazons.

Jaurí, belonging to the same genus as the last, is one of the commonest palms along the banks of the Middle and Upper Amazons, and the clustered, rather slender, but very prickly stems, about thirty feet high, contribute to give a forbidding and monotonous aspect to the low, inundated, sandy shores. It bears an excessively hard nut.

Murumuru, another *astrocaryum*, abounds particularly along the banks of the Marañon. It rarely exceeds fifteen feet in height, but it carries a graceful head of long, pinnate leaves, and formidable spines. A spiny relative, on the Lower Amazons, is significantly called munbaca, or "wake up!"

Inajá, or *Maximiliana regia*, is a fine feathery palm, quite common in the primitive forests along the whole river, but most conspicuous up the Rio Negro, where it is called cocurito. Its large spathe is used as a readymade basket. The

stem is of moderate height, and the leaves, in circles of fives, spread slightly, forming an open vase.

Yágua, the *attaba Humboldtiana*, upon which the great German traveler said Nature had lavished every beauty of form. The smooth, ringed, slender stem rises from twenty to forty feet high, and its leaves, about six in number and over thirty feet long, spring almost vertically into the air, but arch over at the ends. The pinne are arranged vertically, not horizontally as in other palms, and number some two hundred pairs in a single leaf.

Urucurí, or *attaba exelsa*, common to the Brazilian Amazon, has a smooth, columnar stem, nearly fifty feet high, and broad leaves with symmetrical, rigid leaflets. The fruit is burnt for smoking rubber. Another species, the stemless curuá, grows on the Tapajós and Negro, and its fruit contains milk.

Cocconut, the well known *cocos nucifera*, is limited to the Atlantic end of the Amazons, and must be cultivated. As far inland as Manáos it grows, but will not fruit.

Ivory palm. There are two species of this so-called palm, the *phytelephas macrocarpa*, or polo-ponto, and the smaller *p. microcarpa*, or yarína, both growing along the east side of the Andes; and both are different from the Guayaquil species, which has a high trunk. The seeds yield the vegetable ivory of commerce.

THE SCREW PINE OF THE AMAZONS.

Our engraving exhibits a characteristic specimen of the tropical vegetation of South America. Palm-like as the foliage is, the plant is one of the screw pines, contained in



STEMLESS SCREW PINE (*Carludovica humilis*).

the order *pandanacea*. The specimen, being of dwarf growth, is altogether different from the climbing varieties, to which its obvious aerial roots would indicate its close relationship. The leaves are of a fine dark green; and the flowers, which are inconspicuous, are of the monœcious tribe, having the stamens and pistils on separate flowers on the same plant.

Toughened Glass.

About seven years since, M. Francois de la Bastie, a French engineer, after long and patient investigation into the subject, discovered a simple means of rendering glass practically unbreakable, and at the same time of preserving its transparency. Broadly stated, it consists in heating the glass at a certain temperature and plunging it while hot into a bath consisting of a heated oleaginous compound. There are, however, many conditions in connection with the details of the process upon which a satisfactory result depends, and the neglect of any, even in a slight degree, constitutes the difference between success and failure. Thus, the glass may be overheated and will not be susceptible to the effect of the bath, or it may be overheated and it will then lose its shape, or, again, it may be rightly heated and yet be spoiled in the course of transference to the bath. Moreover, the oleaginous constituents of the bath and their temperature have an important bearing upon the ultimate result. These and numerous other points of detail have all been satisfactorily settled by M. de la Bastie, who has designed furnaces and baths by means of which his toughening process can be carried out practically without fear of mischance. The time occupied in the actual process of tempering is merely nominal, for directly the articles are brought to the required temperature they are plunged into the bath and instantly withdrawn. The cost of tempering, too, is stated to be very small.

The physical properties of the material become altered in a very remarkable manner. To this singular fact we can testify, from the inspection of a number of toughened glass articles at the offices of Messrs. Abel Rey and Brothers, 29 Mincing lane, the representatives of M. de la Bastie in England. In these articles, which consisted of watch glasses, plates, dishes, and sheet glass, both colored and plain, neither transparency nor color is affected at all, and the ring or sound only slightly. These articles, some of them being exceedingly thin—were thrown indiscriminately across a room against a wall and fell spinning on the deal floor. Water was boiled in a saucer over a fire and the saucer was quickly removed to a comparatively cold place, and was unaffected by the sudden change of temperature. One corner of a piece of glass was held by the hand in a gas flame until the corner

became exceedingly hot, but the heat was not communicated to the other portion of the glass, neither was it cracked from unequal expansion. A comparative experiment was then made with a piece of ordinary plate glass and a similar piece of toughened glass, in order to show their respective powers of resistance to fracture from the force of impact by a falling weight. In each case the glass was about 6 inches square, and was placed in a frame, the weight being dropped upon its center. With the ordinary glass, a 2 ounce brass weight, falling on it from a height of 12 inches and 18 inches respectively, did no damage, but at 24 inches the glass was broken into several fragments. With a thinner piece of toughened glass, no impression was made by the same weight falling from heights ranging from 2 feet to 10 feet, the weight simply rebounding from off the glass. An 8 ounce iron weight, tried at 2 feet and 4 feet respectively, gave similar results. Upon the height being increased to 6 feet, however, the glass broke. But here another singular result was produced; instead of breaking into about a dozen pieces, as did the ordinary glass, it was literally smashed to atoms. The largest fragments measured half an inch in length and breadth, and these were easily reduced by the fingers to atoms varying in size from that of a pin's point to that of a large pin's head. The lines of fractures in the fragments presented to the eye the appearance of irregular lace work, and these lines were, moreover, apparent to the touch, but more palpably so on one side of the glass than the other. Which of the two sides was the one that received the first impact of the blow, we were not able to determine. Another peculiarity is that the edges of the fractures are by no means so sharp, and therefore capable of causing incised wounds, as are those of ordinary glass. It would seem that the toughened glass possesses enormous cohesive power; but that if the equilibrium of the mass is disturbed at any one point, the disturbance or disintegration instantly extends throughout the whole piece, the atoms no longer possessing the power of cohesion.

Of the practical nature of M. de la Bastie's unique discovery, there can be no question whatever, nor can there be any doubt of its value in the arts, sciences, and manufactures. The applications which suggest themselves are innumerable; and above and beyond the usefulness of the process with regard to articles of domestic use, come important considerations affecting the applied sciences, especially in connection with chemical manufactures and similar industries, where a material, alike uninfluenced by the action of heat or acids, has been so long and so vainly sought for—notably in connection with vitriol chambers in the manufacture of sulphuric acid, and for piping in chemical works. For the present there remains one purpose to which toughened glass cannot be so easily applied, and that is to window glazing in odd sizes, inasmuch as it cannot be cut by a diamond or other ordinary means. Our glaziers will therefore have a respite, but we cannot give them much hope that it will prove a long one, as experiments of considerable promise are being conducted with the view of solving this problem. Moreover, the glass can be cut to the proper sizes before toughening if desirable. The glass, however, is readily engraved, either by fluorid acid in the usual way, or by Mr. Tilghman's elegant sand blast process. It can be easily polished, and it can also be cut by the wheel, as for luster work and the like.—*London Times*.

American Geographical Elevations.

As geographer in the Rocky Mountains Expedition under the charge of Dr. F. V. Hayden, Mr. Jas. T. Gardner found it necessary to fix upon some datum point to serve as a base for the reckoning of altitudes, and met with a first difficulty in the different altitudes assigned to Denver, Colorado, they diverging between 200 and 300 feet. To eliminate the error, he undertook the "reconstructing of all possible lines of level from the ocean to the Rocky Mountains, using only official reports by engineers, and checking them by personal examinations of their note books and working profiles whenever practicable." The following are a few of the levels ascertained.

	feet.
Mean level of Lake Ontario above mean tide level	249.99
" Lake Erie	573.08
" Lake Huron	589.99
" Lake Michigan	589.15
Low water in Ohio at Cincinnati	440.00
Cairo city base, ordinary low water	291.23
Saint Louis directrix	429.29
Omaha, low water base of U. P. R. R.	977.90
" depot grounds	1,060.40
Denver, Col., O. P. & K. P. R. R. passenger depot	5,196.58
Cheyenne, U. P. passenger depot	6,075.28
Golden, Colorado	5,728.68
Ogden, Utah, depot track	4,303.30
Pike's Peak	14,148.66
The level mean tide at Albany, N. Y., above mean tide at New York city, was taken at 4.84 feet, as ascertained by the Coast Survey. A few others of the heights ascertained are—	
	feet.
Quebec, mean tide level	15.37
Montreal, summer water level	30.00
Lake Champlain, mean level at Whitehall	100.84
Pittsburgh, Pa., low water in river	699.20
Louisville, Ky., low water above Falls, about	404.00
New Albany, Ind., low water in 1857	370.75
" depot of L. N. A. & C. R. R.	451.75
Rock Island, Ill., high water in Mississippi in 1852	566.68
Terre Haute, Ind., high water in Wabash	485.55
" ordinary water	467.45
Mount Lincoln, Colorado	14,296.66

IMPROVED WATER WHEEL GOVERNOR.

The water wheel governor herewith illustrated is one which has been in practical use for some years, meeting with a wide-spread success. It has, however, been made the subject, from time to time, of various modifications, tending to simplify its form and add to its strength and general efficiency. The engravings, Figs. 1 and 2, represent the invention in two different forms, in both of which the manufacturer has combined the latest improvements.

The mechanism will be understood from the sectional view, Fig. 3, in which A is a vertical shaft, which, driven by a pulley shaft and bevel gearing, revolves the balls. The latter actuate the collar, B, in the ordinary way, and the col-

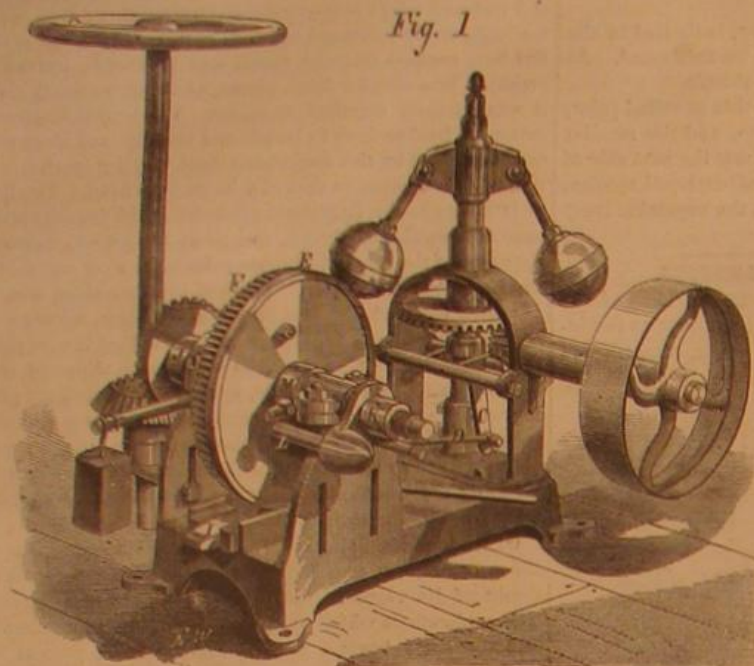


Fig. 1

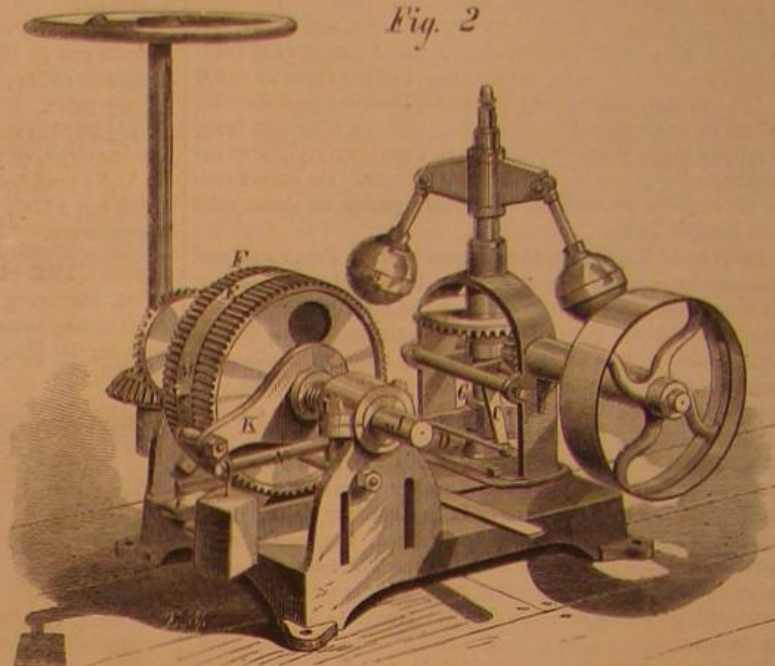


Fig. 2

WALSH'S CHAMPION WATER WHEEL GOVERNOR

lar in turn works the bell crank, C. To the bell crank is pivoted the connecting rod, D, which is similarly connected with the shield, E. This last is either a disk or a sector toothed wheel, F, and is provided in either case with a notch at the bottom, as shown in Fig. 3.

With each revolution of shaft, A, an eccentric, G, through the rod, H, reciprocates the gravity pawls, I, one or the other of which engages the toothed wheel, F, according as the notch in the rim of the shield permits the engagement. As the collar, B, moves up and down with variations of speed, the shield is moved, by the connecting rod, D, above described, so that the notch in the shield allows of the action of the proper shaft. The toothed wheel, F, is fixed to the shaft, J, which is connected to the gate shaft by bevel gearing.

It is obvious that, when the notch in the shield stands mid-way between the pawls, I, neither of the pawls can act. Advantage is taken of this to limit the height to which the gate can be raised by the governor. A nut and arm, K, run in a thread cut on the shaft, J, Fig. 1. The arm carries a pin, L. By the continued action of the pawl that raises the gate, the nut, K, is run along the thread on J, till it finally abuts against a shoulder turned on the shaft, and then turns with the shaft. At the same time the pin, L, is brought under a lug, M, formed on the hub of the shield. The shield is thus turned so as to bring the notch to the center, where, as neither of the pawls can act, the gate cannot be further

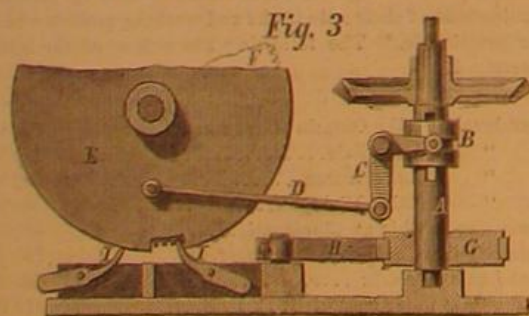


Fig. 3

raised. As soon as the speed of the general shafting, to which the governor is belted, increases, the action of the collar, B, and bell crank, C, Fig. 3, moves the notch of the center so that the proper pawl to lower the gate acts as before.

Fig. 2 represents a governor made to act by two eccentrics, two systems of pawls, and two toothed wheels, so as to raise or lower the gate faster than the single system will: this style of governor being designed for certain turbines, the gates of which are operated with screws which require many turns to open or close the gate.

A friction brake, N, Fig. 1, is employed to hold the shaft, J, from turning back, as it will in some cases during the intervals between the impulses imparted by the pawls.

There is little to be added relative to this invention other than to note the fact that over 500 are now in use. It possesses the important advantages of simplicity and durability, and, according to the manufacturer, it is adapted to meet the requirements of all kinds of wheels under every circumstance.

Further particulars may be obtained by addressing Mr. A. Walsh, Cambridge, New York.

Recent Researches in Artificial Light for Photography.

We recently adverted to a new and brilliant light, said to be utilizable for photographic purposes, and based on the employment of binoxide of nitrogen and sulphide of carbon. MM. Riche and Bady have recently conducted a series of experiments upon this and other modes of illumination, with a view of determining whether it was the carbon or the sulphur which gave to the light its photogenic properties, and as to whether it were possible to construct a lamp simpler in form and free from the danger of explosion incident to the use of the gases above named. The result of their investigations shows the following comparative statement of photogenic power: Oxyhydric and Drummond light, 1; zinc burn-

add gradually, stirring constantly, 3 parts of aqua fortis, or enough to prevent the glue hardening when cool.

A New Fat and a New Source of Borax.

In the course of a new work recently written by Mr. Arthur Robottom, of Birmingham, Eng., entitled "A Visit to Strange Countries in Search of New Products," the author describes the curious "mutton birds" of the Pacific coast and islands. These birds burrow in the ground like rabbits, and are remarkable for their fat, which, the writer thinks, might be rendered available for lubricating purposes, inasmuch as it has a viscosity approaching to that of the oil which is found in the head of the sperm whale. The present scarcity, and high value of sperm oil give great importance to any

ing in oxygen, 4; magnesium lamp, 5; binoxide of nitrogen without sulphide of carbon, 6, and a jet of oxygen delivered upon sulphur, 8. From this it appears that the mixture of binoxide of nitrogen and sulphide of carbon is useless, since the simpler light last mentioned is more advantageous. The fumes of sulphurous acid arising from the latter are easily conducted away by a bell placed above the flame, communicating with the chimney of the apartment and so producing an upward draft.

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

A simple method of determining the quantity of cream in any sample of milk consists in agitating the milk in a graduated glass tube with its bulk of ether for four or five minutes. Add alcohol in volume equal to that of the milk, and shake for five minutes. Place the tube vertically and allow it to rest for a brief period, when the oily matter will rise to the surface so that its amount may be read off on the scale and the percentage easily computed.

A good varnish for maps is made of 1 ounce Canada balsam and 2 ounces spirits of turpentine. This is laid on with a soft brush, over a thin coating of isinglass previously dried.

To remove the stains on spoons caused by using them for boiled eggs, rub with common salt.

Oak timber loses about one fifth of its weight in seasoning, and about one third of its weight in becoming perfectly dry.

To disinfect moldy casks, first wash for about five minutes with an alkaline solution of soda, and then soak for one or two days with a liquor acidulated with hydrochloric acid.

A wound made by a knife or other sharp instrument is best healed by bringing the edges together and putting on a bandage which will not exclude the air. Nature will work the cure, if the person be healthy, much better than any salve or ointment.

A good transfer paper for copying monumental inscriptions and metallic patterns may be made by rubbing a mixture of black lead and soap over the surface of common silver paper.

An ox will consume two per cent of his weight of hay per day to maintain his condition. If put to moderate labor, an increase of this quantity to three per cent will enable him to perform his work and still maintain his flesh. If he is to be fattened, he requires about four and a half per cent of his weight daily in nutritious food.

The strongest side of a piece of timber is that which in its natural position faced the north.

A good zinc wash for rooms is made of oxide of zinc mixed with common size, and applied like whitewash. After it is dry, put on a wash of chloride of zinc, which will produce a glossy surface.

Too great care of the health at this period of the year cannot be exercised. Because a few days are open, bright, and warm, all the windows in the house should not be thrown open, the fire put out, or flannels thrown aside. It is better to err on the safe side, and endure the trifling discomfort, than, by free exposure, to invite pneumonia and other diseases common during the damp weather of a late spring.

To make liquid glue, dissolve 33 parts of best glue on the steam bath in a porcelain vessel, in 36 parts of water. Then

kind of oil or fat which can take its place for the lubrication of cotton spindles and like motions; and hence it is believed that the fat of the mutton bird should be carefully tested for that purpose.

The same author mentions a cañon in Southern California, which leads the traveler to the bed of an ancient lake. On this bed is a marvelous deposit of borax, several feet in depth. The salt is found in huge crystals, some as large as a man's fist, and is of remarkable purity. The locality is known as Death's Valley, and some of the borax gathered there has already found its way to the markets. A greater export would be made if the road between the deposit and the coast offered better facilities for transportation.

IMPROVED MEAT TENDERER.

We illustrate herewith a handy device for rendering tough meat tender, intended as a substitute for the usual practice of pounding. The tool consists simply of an assemblage of sharpened steel blades, which are inserted in a metal socket and held apart by pieces of wood, the whole being confined by a set screw at the end of the supporting rod, so that the blades are easily removable for sharpening.



The mode of operating the invention is by drawing the cutting edge over the surface of the meat in various directions until the stringy portions are thoroughly divided, the device being held by a suitable handle, as represented in the engraving.

For further particulars address the Desper Manufacturing Company, Barre, Mass. (See advertisement which appears on another page).

New versus Old Seeds.

Persons, in ordering their seeds for spring planting, should be sure to obtain them of reliable seed dealers. Seed will not germinate if they are too old; and disappointment and delay often result. Experience of seedsmen indicates that, properly gathered and preserved, beans will retain vitality 2 years; beet, 7; cabbage, 4; carrot, 2; sweet corn, 2; cucumber, 10; lettuce, 3; melon, 10; onion, 1; parsnip 1; peas, 2; radish, 3; squash, 10; tomato, 7; turnip, 4.

NEW DESIGN FOR A CONSERVATORY.

Our readers are no doubt familiar with many graceful structures of iron and glass for raising tropical and other plants, but the wooden erections for the same purpose have hitherto been more remarkable for cheapness and utility than for elegance. But there are many localities where iron buildings are not easily obtained, and where the most available architect is a capable and practical carpenter. To the inhabitants of such districts we commend the engraving of a curvilinear hothouse, built entirely of timber and glass. It is the invention and design of Mr. Lascelles, a London carpenter, who has given much attention to the needs of horticulture. This original and useful plan seems to us to effect a revolution in the art of hothouse building, and a very desirable revolution, too. "The curved wooden spandrils of the roof," says *The Garden*, "consist each of three pieces, bent by steam, and very accurately fitted together. Although, however, the spandrils are bent, the glass is not; and in this there is a decided advantage, inasmuch as a difficulty is often experienced in replacing broken squares when such is the case. The interior is divided into three compartments, which afford plenty of space, not only for plants of comparatively small size, but also for the larger forms of tropical vegetation."

Noise as a Nuisance.

In one of the Chancery courts in England, recently, a case, *Beaumont versus Emery*, was heard, of some importance to persons residing in the neighborhood of noisy manufactories. The defendant is a cooper, carrying on business in the rear part of the plaintiff's house, and had been in the habit of using a high pressure steam engine at work day and night. The plaintiff complained that the vibration and noise caused by this engine were such as to create an intolerable nuisance, and he filed this bill, praying that the defendant might be restrained by injunction from working the steam engine. The Vice Chancellor said he was of opinion that the plaintiff had established his case, and there must, therefore, be an injunction to restrain the defendant from working the steam engine between the hours of seven P. M. and six A. M., without the plaintiff's consent.

SUMMER HOUSES.

The opening of spring calls our attention to the requirements of the garden, and the arrangements necessary for our

comfort during the season when we live as much as possible in the open air; and many of our readers will find some useful suggestions in the annexed engraving of a summer house, even if they do not feel inclined to carry out the plan in its entirety. The design is by Mr. J. C. Fox, of the Royal Horticultural Society's gardens, South Kensington, London; and we believe that there cannot be two opinions as to the usefulness and beauty of the structure. As it will be seen, it is raised above the surface, so that it is secure from dampness in the worst weather; its projecting gables insure the re-

This design can, of course, be varied to suit the grounds and the needs or the means of the owner; but its general appearance of comfort and rusticity is, in our opinion, pleasing to the eye, and especially appropriate to its intended use. The growing taste for horticulture, of which we have daily such abundant evidence, gives additional value to this tasteful representation.

Rheumatism in the Horse and other Animals.

Rheumatism is sometimes defined as inflammation of the fibrous tissues, tendons, and ligaments, and the fibrous coverings of muscle; but it must be understood that the inflammatory state is quite distinct from the ordinary disease. What change in the constitution of the blood is essential to the development of rheumatism is not well ascertained; but there is no doubt that lithic acid, or one of its allies, is abundantly formed and largely excreted from the system. It is probable that the same error in the nutritive functions which causes the formation of uric acid may also induce other chemical or physical changes which have not yet been recognized; but the facts go no further than we have stated. Rheumatism is a peculiar form of inflammation of the white fibrous tissues, associated with the formation of an excess of uric or lithic acid, and the presence of an unusual proportion of fibrin in the blood.

Rheumatism may be acute and general, accompanied with various degrees of fever; or it may be strictly local, and productive of no more severe constitutional disturbance than would naturally arise from the pain

LASCELLES' CURVILINEAR WOODEN CONSERVATORY.

quisite amount of shade; and the climbing plants, which are its best means of decoration, seem to grow up around and to cover it, almost as a part of itself.

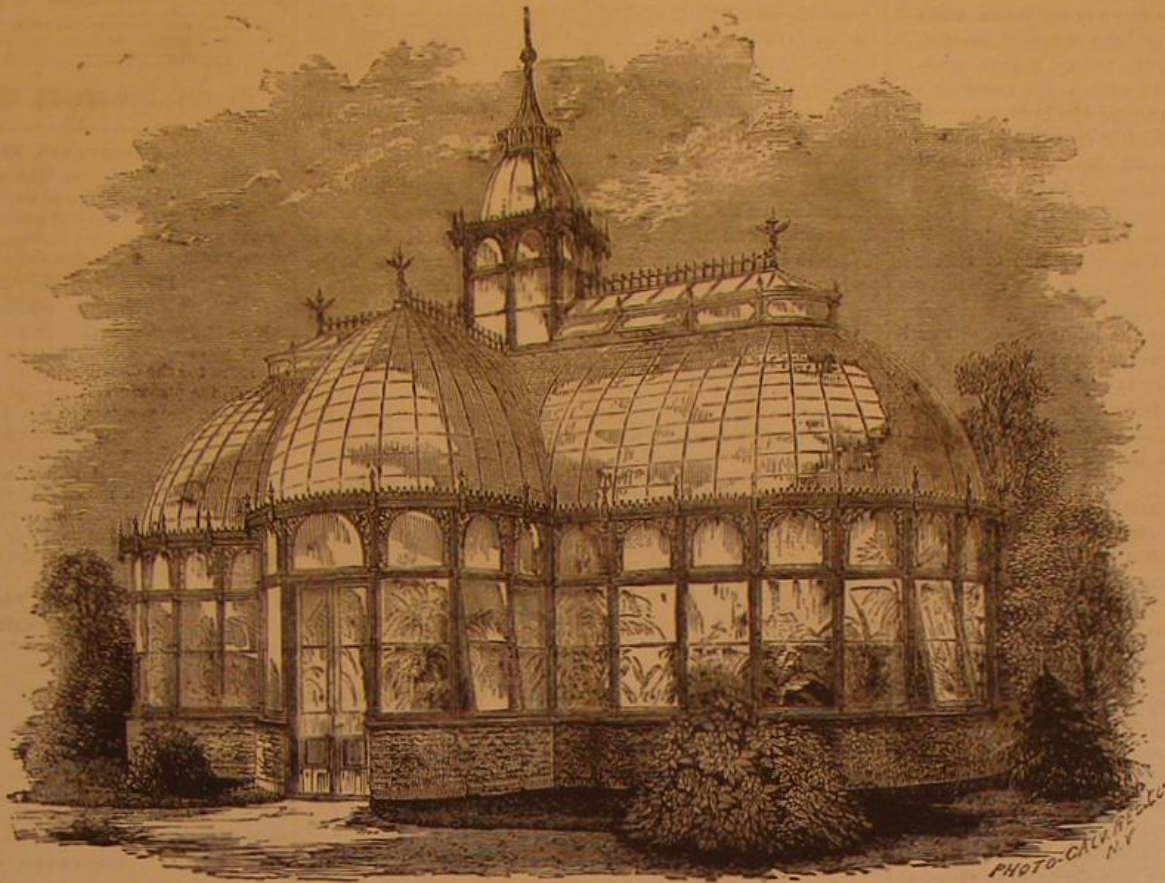
"What is so enjoyable in hot weather," says *The Farmer*, "as to be enabled to leave the close atmosphere of a dwelling, and retire to the coolness of a summer house, where the luxury of fresh air can be obtained without exposure to the heat of the sun?"

"The desire for these erections being so general, it devolves on those who have made garden architecture their study to lead this taste in the right direction, and to place before villa gardeners structures conceived on correct principles, distinguished at once by beauty of design, strength, and solidity of construction, convenience of arrangement, and economy of cost."

in the inflamed part.

Acute rheumatism sometimes attacks the fibrous tissue connected with the muscles of the back in horses and cattle, the latter particularly, in consequence of their more frequent exposure to inclement weather. The milder form of the disease is very common among horses, and generally affects the synovial sacs in the vicinity of joints. In both forms rheumatism is always associated with a tendency to the deposit of fibrin; and in the acute variety of the affection, the serous membranes of the heart often suffer seriously, but not to the same extent in the lower animals as in man.

Causes of rheumatism are ordinary and special. Common causes, which are those most readily appreciated, are exposures to wet and cold, or sudden changes of temperature. A sudden attack of rheumatic disease will often be attribu-



DESIGN FOR A RUSTIC SUMMER HOUSE.

ted to a journey in the wet or exposure to a draft of cold air; but these ordinary influences can only have the effect of determining the location of the disease, the necessary conditions for the development of which must have existed previously.

Symptoms of rheumatism vary according to the severity of the attack. In the acute form of the affection, there are loss of appetite, quick full pulse, rapid breathing, stiffness of movement, and sometimes incapacity to move at all. Cattle, when attacked with acute rheumatism of the muscles of the back and quarters, will often lie down and refuse to rise; and, if not got up by force, they may remain in that position until they die from exhaustion, or from failure of the heart's action owing to the extension of the disease to that organ.

Horses when similarly affected remain in the standing position, with the hind legs drawn under the body, presenting something of the appearance which is apparent in acute inflammation of the fore feet; in fact, we have known this disease to be mistaken for rheumatism of the muscles of the back, and we have heard of the opposite error being made, an attack of rheumatism in the back having been treated as inflammation of the fore feet. The symptoms of rheumatism, however, are sufficiently marked to enable an acute observer to distinguish it from any other affection.

When the inflammation attacks the joints of the extremities, one peculiarity is sufficient to indicate the nature of the malady—we refer to the tendency to shift from one part of the limb to another; the right fetlock may be swollen one day, and the left knee on the following day; and again in a short time the disease may quit the fore limbs altogether, and appear in the hind joints.

In the sub-acute form of rheumatic disease, the frequent change of position is a characteristic symptom; but in the most acute form, when the constitutional disturbance is most severe, the tendency to shift from one part to another is not so commonly noticed.

One variety of rheumatism is especially annoying as a sequel to febrile diseases. A horse, which has recovered from an attack of influenza or bronchitis, suddenly becomes excessively lame from inflammatory swellings above the fetlocks, probably of the forelegs. The disease may yield to treatment to some extent, but, almost as soon as any improvement occurs in one part, the disease assumes a more active form in another; and many weeks may be occupied in trying various forms of treatment with more or less success. In the majority of cases soundness is ultimately restored, and it does not appear that the acute or chronic form of rheumatism leaves behind it any tendency to the malady.

Treatment of rheumatism is generally based on the assumption that the disease is due, in a great degree, to the presence of an excess of acid in the blood and secretions. It is undoubtedly true that there is an excess of fibrinous material in that fluid; and there is also, in most cases, considerable constitutional debility. These conditions point to a consistent plan of treatment; it is necessary to eliminate morbid materials from the system, and to support the vital powers at the same time by generous diet.

Nitrate of potash and also carbonate of potash are valuable remedies in rheumatism, the former especially from its influence on the fibrin of the blood, while, at the same time, it excites the secretive action of the kidneys. Laxative medicines are required in the febrile stage of the disease; and when the fever has subsided, tonics may be necessary, particularly if the animal's appetite is not very good.

Local treatment is indispensable in cases where the joints, or the synovial capsules connected with joints, are involved, and experience is decidedly in favor of blistering the parts at once, in preference to fomenting with warm water or applying a stimulating liniment. The relief which is afforded by a blister is commonly very marked immediately after the remedy has taken effect, and in all instances the repetition of the dressing may be expected to produce satisfactory results. —London Field.

ASTRONOMICAL NOTES.

OBSERVATORY OF VASSAR COLLEGE.

For the computations of the following notes (which are approximate only) and for most of the observations, I am indebted to students. M.M.

Positions of Planets for May, 1875.

Mercury.

Mercury cannot be seen before the latter half of the month. On the 22d it passes the meridian an hour after the sun, and should be looked for after sunset, farther north than the point of disappearance of the sun. It sets later and later every evening, and on the 31st it does not go below the horizon until after 9 in the evening.

Venus.

Venus, although less brilliant, can still be seen in the morning, as it rises at 3h. 30m. on the 1st of May, and comes to meridian 19m. before 10 A. M. On the 31st Venus rises at 3h. 8m. in the morning, and sets at 4h. 44m. P. M.

Mars.

Mars is increasing in apparent diameter, but is also moving farther south in declination, and is not well situated for observation. It rises on the 1st at 11h. 9m. P. M., and can be known by its ruddy light. On the 30th, Mars rises at 9h. 25m. P. M., and sets on the 31st at 5h. 59m. A. M.

Jupiter.

Jupiter is now the most conspicuous planet in our evening skies. It rises on the 1st at 5h. 25m. P. M., and sets at 4h. 26m. the next morning. On the 31st Jupiter rises at 3h. 14m. P. M., and sets at 2h. 21m. A. M. of the next day.

Jupiter has four moons, and they can be seen with a small glass, generally in a line nearly parallel with the equator of the planet. But sometimes they are invisible by being behind the planet, as in occultations, by being in the planet's shadow, as in an eclipse, sometimes by being in front of the planet, between us and the planets, as in transits.

The occultations and the eclipses can be seen with small instruments, but the transits cannot be seen without good glasses, the little moon being generally so much like Jupiter in color as to be undistinguishable from the planet. On the 7th, the third satellite, which is the largest, will disappear (to be seen with a glass of low power) at 7h. 11m. 41s. (Washington time) by coming between the Earth and Jupiter, in transit. On the 18th, the same satellite will disappear, by going into the shadow of Jupiter, at 7h. 59m. 8s. (Washington time), or by eclipse. On the 25th the same satellite will disappear at 8h. 18m. by being behind the planet, or by occultation.

Saturn.

Saturn does not rise until after 2 in the morning of the 1st, and sets a little after noon. On the 31st it rises a few minutes after midnight and sets at 10h. 30m. A. M. It is far south in declination, and, although coming into better position, is still very unfavorably situated for observation.

Uranus.

Uranus rises on the 1st at 11h. 10m. A. M., and sets at 1h. 26m. the next morning. On the 31st Uranus rises at 9h. 16m. A. M., and sets at 11h. 29m. P. M.

It may be found by sweeping with a small telescope in the region east of the Beehive in Cancer.

Neptune.

The diurnal path of Neptune is so nearly that of the sun that it cannot be observed at this time.

Sun Spots.

The large spot mentioned in the last report, as having appeared a second time, made its passage across the disk with no noticeable change in appearance. It was last seen on the western limb, March 29, and did not return again at the time when (by the sun's revolution) it was expected, about April 14. Two clearly defined spots of good size appeared within the eastern limb on April 10, and the photograph of the 14th (none having been taken since the 10th) shows them to be preceded by another of nearly equal size. These three are still on the disk (April 18), the pair having completed about two thirds of their passage. Besides those mentioned, spots have been few and very small during the last few weeks, and no faculae have been observed. A little group, which was first seen on March 29, was of interest, as it was well defined and passed the center of the disk, yet not visible in the last picture taken, that of the 27th.

Silas Henry Hodges.

Ex-Commissioner of Patents Hodges, who was appointed to that office by President Fillmore, and who, for the last fourteen years, has been one of the board of three examiners-in-chief appointed by Congress to hear appeals from the decisions of the examiners, died in Washington, D. C., on April 20. He was a native of Clarendon, Vt., born in 1804, and for some years practiced as a lawyer in Rutland, in the same State. A natural predilection for mechanical science gave him great success in patent cases, and enlisted him in the service of the Patent Office, in which he acquired a high reputation for learning, acuteness, and accuracy. For some years he had been suffering from a painful internal disease, which he bore with patience, continuing his labors with great courage and fidelity. His removal from this life has caused widespread regret, and elicited many indications of the universal respect in which he was held.

Patent Office Changes.

General William H. Brown, the present examiner of trade marks, resigns his position from the 30th of April, in order to resume the practice of the law. He will be succeeded by Mr. J. E. M. Bowen, for several years connected with the interference division of the Patent Office, and now first assistant examiner in the class of mechanical engineering.

A GOOD LOCOMOTIVE.—Passenger engine J. S. Taylor, No. 105, Daniel Kenyon, engineer, running between Paterson, Newark, and Jersey City, has accomplished the remarkable feat of running 80,473 miles without repairs. The main rod brasses during the period have not been filed, and the driving brasses are still in excellent condition for further work.

DECISIONS OF THE COURTS.

United States Circuit Court—Southern District of Ohio.

PATENT BUNG.—PHILIP GEIER vs. AUGUST GOETTINGER.

[In equity.—Before SWING, J.—October term 1874.]

Letters patent to Philip Geier, of February 23, 1869, for "Improved Method of rendering Wooden Bungs Impervious to Liquids and Gases," construed and sustained.

SWING, J.: The patent recites that Philip Geier alleges that he invented a "new and useful improved mode of rendering wooden bungs impervious to liquids and gases." In the schedule the patentee says he has invented "a new and useful improvement in wooden bungs," and says: "My invention consists in rendering wooden bungs impervious to the passage of gases, or beer or other liquor, through the pores of the wood by means of any suitable substance." The drawing shows a bung with a coat of the impervious material. Then the substance used is described, as also its manner of application. This claim is: "A wooden bung rendered impervious to the passage of fluids through the pores of the wood by means of the described or other suitable substance."

I think, from the patent, specifications, and drawings, that the invention of the patentee consisted in a wooden bung rendered impervious to the passage of gases or beer or other liquids. This is the thing he has produced. This is the end he has accomplished, and a fair interpretation and application of the language used cannot well bear any other construction.

The patentee points out the method by which his invention is produced, and the material used—to wit, by the application of impervious material to the end of the wooden bung. He also describes a particular material, which he regards as most suitable, but claims the use of any suitable substance for accomplishing the result.

The presumptions of the law are in favor of the patent and the utility of the invention. The testimony shows that many experiments had been made, prior to complainant's invention, to produce such a thing; but they had failed to produce one adapted to the use for which they were desired.

So far as the prior use of the respondent is concerned the testimony does not show that his experiments were more successful than many others, for it shows that the bungs which he manufactured did not answer the purpose, and the use thereof was abandoned.

It is attempted to be shown in the testimony, however, that the invention had been used by other parties than those set up in a sewer; and it is also attempted to be shown that the invention had been described in printed publications. If the testimony clearly established either of these propositions, we might, perhaps, grant the respondent leave to amend; but they do not so clearly establish either point as to warrant the court to permit such an amendment at the hearing of the case. Such testimony cannot, therefore, be considered by the court, except for the purpose of showing the state of the art at the time of complainant's invention, and such knowledge would in no wise affect the construction which I have given to the patent.

If the pleadings properly raised the issue, I should not think the patent void by reason of the claim being too broad.

The respondent having admitted the manufacture of the invention of the complainant, by the use of substances which are within complainant's patent, is, therefore guilty of an infringement; and, as no reference is desired, and the damage shown is but fifteen cents, a decree for an injunction will be granted without costs.

[Dunham and Foraker, for complainant. Shuster & Smith, for defendant.]

Recent American and Foreign Patents.

Improved Side Hill Plow.

Charles Henry Stratton, Monroeton, Pa.—This is an improved reversible or side hill plow, so constructed as to turn the furrow perfectly, and to work equally well upon inclined and level land, so as to do away with all dead furrows. The mold board is made in two parts, and so arranged that the one part may swing or turn below, and the other above, the landside of said plow.

Improved Seed Dropper.

Elias M. Morgan, Belleville, Ill., assignor to Henry Rentschler, of same place.—This invention consists of an improved piston and aperture for the distribution of seed or grain. By the revolving of a shaft, the piston works up and down through the cup. The piston is made in two sections, so put together as to form the adjustable seed openings by means of recesses in their edges. The cup, through which the piston works, is provided on either side with a groove, headed by a V-shaped recess, which strikes off the seed as it is measured at each motion of the piston, and also said recesses gather the grain or seed in toward the center or groove, and the seed thus driven to the center is held in a position to escape breakage, as the plane surface on the upper part of the piston enters the aperture.

Improved Horse Hay Rake.

James E. Taylor, Westminster, Md.—The invention relates to novel means whereby a horse rake may be conveniently operated with the foot of driver, no matter what may be his size or length of leg. It consists in an adjustable foot piece very advantageously arranged on a vertical rod, so that it can be graduated at pleasure, while the rod itself also subserves another purpose.

Improved Piano Stool.

Charles A. A. Düring and John Leck, New York city.—This invention consists of an inwardly curved or convex back support, attached in an adjustable manner to a piano stool or other seat, to be set exactly to the height of the small of the back.

Improved Car Coupler.

James S. Hagerty, Baltimore, Md.—This invention relates to certain improvements in coupling the pole to a horse car so as to enable it to be held up by the car, and thus take the continuous strain from the necks of the horses; also in a bent rod affixed to the pole and serving the double purpose as a retainer for the coupling pin and a handle wherewith the driver may manipulate the tongue in reversing his team.

Improved Manufacture of Sheet Wax for Flowers.

Mary Jane McCall, Hoboken, N. J.—Sheets of wax are prepared by cutting out of a cake of suitable color the parts or grounding of the leaf to be produced—as, for instance, in the case of a geranium leaf, from a cake of green wax, the shape of the dark green part of the leaf. This leaf-shaped piece is introduced into a cake of wax having the color of the surrounding part or fringe of the leaf, which cake has previously been heated to such a temperature that it is near the melting point, so that the differently colored cake leaf may readily sink therein, and be fully surrounded or embedded by the heated wax. The whole is then allowed to cool off, when the cake is cut into the sheets in the usual manner, said sheets exhibiting, at uniform thickness, the various differently colored leaf patterns or imitations embodied therein. These sheets are lined or backed by a sheet of wax, to give the required degree of strength, and are thus supplied to the trade.

Improved Gang Plow.

James B. Hunter, Ashley, Ill.—To the right hand plow beam the draft is attached. The left hand plow beam is bent inward and bolted to the side of the other beam. A U-shaped bar is secured to the axle, and to its bend is secured the lower end of a standard, the upper end of which passes up through the tongue, and is secured to said tongue by a bolt, several holes being formed in said standard to receive the said bolt, so that the tongue can be conveniently raised and lowered upon the standard to adjust the plows to work deeper or shallower in the ground.

Improved Brick Kiln.

Peter Edward Smith, Liscomb, Iowa.—This invention relates to certain improvements in brick kilns, and it consists in the combination of a transverse wall having dampers, with a central longitudinal hollow wall containing flues which lead to a common chimney. It also consists in the combination of detachable fire boxes with the stationary fire boxes in the outer wall, and with the flues in the hollow wall.

Improved Plow.

Albert Hampe, Staunton, Ill.—The plowshare is produced of four sections, which fit closely at the joints, and are of such shape and size as to correspond to the degree of work and strain bearing on them. A plate extends laterally and parallel to the lower edge of plowshare, being curved in similar shape and welded to the landside. The point has a horizontal base and a dovetailed recess or notch to receive the forward end of the landside and of the plate. This causes the landside and share to be supported rigidly in position, and to safely endure comparatively great strain and leverage.

Improved Seed Drill and Planter.

Lysander L. Haworth, London, Ohio.—By this peculiar plow a narrow channel is formed in the soil to receive the seed, which is dropped into the said channel through the cavity between the side parts of the plow, and is covered by the falling of the soil as the plow advances, the soil being pressed down upon the seed by the wheel. For working in sod land, a curved runner with a sharp forward edge is attached to the plow, or is used instead of said plow.

Improved Chimney Cowl.

Andrew J. Robinson, Troy, N. Y.—In the revolving section of the exhaust pipe, through which ventilation is to be effected, a partition is placed obliquely, for causing the stream of air passing through to traverse the upper part, to afford greater space for the air coming out of the exhaust pipe.

Improved Truss.

Delancy King, Salamanca, N. Y.—This consists of a pad formed of four, more or less, hinged fingers the position of which is controlled by an adjustable ring.

Improved Latch and Knob Lock.

Charles Seymour, Charlottesville, Va.—The object of this invention is to provide a simple and effective lock for all kinds of doors, without the use of springs; and it consists in the peculiar construction of a bolt operated by its own weight, and in the combination with the same of a tumbler contained within a concentric barrel, whereby the bolt is locked at night with greater security.

Improved Machine for Rolling Tapered Bars.

Thomas R. Venners and Richard Rowley, Cumberland, Md.—This is an improved roll train, by which bars of iron or other metal of any section may be rolled to any gage, length, or taper. It consists in the combination, with a lower stationary roll, of an upper sliding roll, that is governed by the action of the eccentrics of a revolving top shaft on the steel pins of the roll bearings, in connection with the arched top straps bolted to their guide carriages. The roll train may be readily set, by the removal of the lower gear wheel, to perform the functions of the common rolls, provided that a suitable stop is attached to the eccentric shaft of the top wheel for securing the exact distance of the rolls.

Improved Pocket Book Safety Attachment.

Edwin G. Wheeler, Winona, Minn.—A couple of arms are arranged on the side of the book, to be thrust out at one end by a spring against the pocket, and spread apart, so as to prevent the book from being picked out of the pocket. The arms are arranged on fixed joints, and a bar serves, in connection with a lever, to lock them open.

Improved Piano Stringing and Tuning Device.

William F. Kearsing, New York city.—This invention consists in connecting the strings to stationary rest pins by a U-shaped staple, one leg of which is screw-threaded to receive a nut, and the other is parallel thereto and passing through the rest pin, thus serving to prevent the device from turning with the adjusting nut when the tension of the strings is being regulated.

Improved Wrought Iron Column.

John B. Cornell, New York city.—This invention consists in a fender for a supporting column connected to the foundation plate, to form a lateral support to the column.

Improved Railroad Pinch Bar.

Cornelius Ragan, Waterloo, Iowa.—The base piece of the pinch bar is connected with the plate which covers the rail by a swivel pin. This base piece extends upward and has two jaws, through which passes the fulcrum pin of a lever. A tenon on the under side of the lever fills the space between the jaws, and receives the fulcrum pin. The base of the pinch bar being swiveled to the plate, the lever may be used quartering beneath the wheel, if desired. As the wheel moves along on the rail, the pinch bar and plate are pushed after it, being confined to the rail by the banded edges of the plate, which inclose the rail.

Improved Car Coupling.

Charles C. Garrett, Calvert, Tex., assignor to himself and Louis M. Openheimer, same place.—When the cars are run together, the end of the entering link pushes back the lower end of a pin and passes it, which allows the pin to swing forward into the link to couple the cars. To adjust the coupling, so that the cars can be run together without coupling, certain portions are raised sufficiently to raise the pin out of the slot in the drawhead. The lower end of the pin is then swung out, and bars are lowered, leaving the end of the pin resting upon the top of the drawhead.

Improved Feed Cutter.

Johann A. Schwerdt, New York city.—This invention consists in an arrangement of feed rollers, pawl levers, connecting rods, a treadle lever, and a wheel carrying two blades or cutters, and mounted on a crank shaft, said parts being so connected that the rollers are simultaneously operated at each half revolution of the wheel, and the straw or other material fed forward just previous to the cutting stroke of each blade.

Improved Stove-Lid Lifter.

Robert R. Ball, West Meriden, Conn.—The lifter, from near the toe to the handle, is made concave on the underside and convex on the upper side, the concavo-convex portion terminating on a disk, but extending from the other side of the disk to a handle, forming a cap. The ferrule is slipped on next the disk and the handle is driven in, and a holding nail inserted.

Improved Hay and Cotton Press.

Benjamin J. Day, Evansville, Ind.—This is a press having a horizontal case and a horizontal follower, which is worked by a train or reducing gears working into toothed bars connected to the follower, to press the hay or other matter. The essential feature consists of a novel contrivance of the train in a simple and cheap way, for giving a quicker speed to the follower during the fore part of the operation, when the resistance is not so great as in the latter part, and for giving a slower speed in the latter part, when the resistance is greatest.

Improved Machine for Forming Gear Wheel Molds.

James Clayton, Portsmouth, Ohio.—The mode of forming the mold is as follows: The bottom is first formed by a mold board on the bed of the machine, the marker is then placed on the outer division of the flange ring, and the guide arms firmly fixed thereon. The tooth pattern is then lowered, and the sand firmly rammed in between it and the flange ring. The pattern is then raised, and the marker and guide arms adjusted for the next tooth, and the space rammed with sand, as before. This operation is continued until all the teeth of the gear wheel are molded.

Improved Neck-Tie Fastening.

Emile Berliner, New York city.—This is a metallic or wire hoop, adapted to fit upon the neck or shank of a collar button, and thus suspend the tie in a simple and permanent manner.

Improved Grain Drill Teeth.

Isaac B. Sandusky, Lexington, Ky.—This invention consists in the construction of the drill tooth and seed spout in two corresponding parts, which, when secured together, furnish bearings for a cutter wheel that revolves between them and enters the ground in advance of the tooth.

Improved Automatic Cradle.

William Kindermann, Troutville, Pa.—The cradle is set in motion by a gentle push, and keeps up the rocking by the action of a clock train and pendulum rod. The cradle may be stopped when the baby is asleep, being again set to rock by the impatient and restless motions of the awakening child, forming a complete self-acting baby tender.

Improved Nail Plate Feeder.

William H. Field, Taunton, Mass.—The forked and slotted feeder bar or rear extending standard is attached to the main yoke standard and provided with adjustable stops, in combination with a sliding and weighted feeder head, which has pivoted and spring-actuated jaws for taking hold of the flanged sleeve end of the nipper rod. The sliding feeder head is also provided with a rear extending latch hook and vertically sliding pin, acting on the opposite arm of the same, for raising the latch from the rear stop, and detaching the feeder head on the insertion of the nipper rod and on the consequent depression of the pin.

Improved Combined Try Square and Bevel.

John L. Larrison, Schooley's Mountain, N. J., and Henry Leigh, Wurtsborough, N. Y.—To the semicircular end of this tool an adjustable and graduated rule, with a longitudinal slot, is applied in such a manner that it may be moved along a pivot pin to any point of the slot, and also be swung thereon, to form any suitable angle with the main piece. The rule may thus be carried to the end of its slot in either direction from the main piece, so as to form a square or bevel with the same, and also in the exact protrusion of the same, by sliding with its end into a recess of the main piece, producing one straight rule therewith. The exact position of the rule to the required angle may be quickly adjusted by means of a sliding rod, which is guided in a longitudinal groove, being provided with a pointer, which is set to a graduation of the main piece, while a pin at the end of the rod passes through the slot of the rule and swings the same into the exact angle indicated by the pointer.

Improved Clothes Frame.

Chester F. Smith, Torrington, Conn.—The drying frame is suspended from the ceiling of the room by brackets on the ends of the side pieces. These brackets are attached by joint pins, and swing freely in either direction thereon. A stud on the brackets, the end of which bears against the ceiling, throws the frame into an inclined position.

Improved Car Coupling.

Owen T. Baker, Wamego, Kan.—The cavity of the bumper head is made large, to receive two valves, which are pivoted to the bottom and top of the bumper. The lower part of the valves is beveled or inclined to press against the end of the link and hold it horizontal, and to form flanges upon their upper edges to operate upon the coupling pin. The upper pivots of the valve project into a chamber formed upon the top of the bumper, and to these are rigidly attached levers, with which are connected the ends of a spring. To adjust the coupling to connect the cars as they run together, the lower end of the pin is set upon the upper edge of the valves; then, as the cars are run together, the entering link pushes back the valve, and the pin drops through the link.

Improved Hog Trap.

James F. Cooper and William W. Hiatt, Frankton, Ind.—This is an improved trap for catching and holding hogs while ringing, marking, castrating, or spaying them, or performing any other desired operation upon them, holding the hogs securely and in such a way that they cannot injure themselves. In using the trap, one or more of the hogs is driven into it, and the door is closed. The lower end of a board is swung outward sufficiently to allow one of the hogs to put his head through the opening in seeking to escape, and the lower end of said board is then pushed inward so far as to prevent him from withdrawing his head. The hog is then thrown upon his side.

Improved Stove Pipe Coupling.

Robert R. Ball, West Meriden, Conn.—Beads are made near the ends of the pipe, and the parts are slipped over the ends and down to the beads, where the ends of the pipe are turned down with the pene end of a hammer. Slots are made in one part, and directly over the slots and above a shoulder on the other part are hooks. The two parts of the coupling are held together by hooks over a flange. Inclined planes, as one part is turned around, pass under the hooks and draw the parts of the coupling tightly together, thus making the two joints of pipe rigid and strong. This coupling utilizes the entire length of the stove pipe, saving about three inches in each joint.

Improved Retractor.

Alvin H. Dodd, New York city.—The graduated arc has a fixed arm, whose base is a true line from the center, and extending through the zero point. On the said arc are one or more movable arms which travel thereon, and the outer periphery of the arc is made with an incline, which bears against a similar incline in the recess on the arm. When a plate is clamped by turning a thumb screw, it will bear down on the arc, and thus cause the arm to be drawn closely to the inner periphery of the same.

Improved Photographic Picture Exhibitor.

A. Luquace High, Mount Holly, N. J.—An outer inclosing frame has a glass-covered face plate provided with one or more apertures, and a central spindle on which revolving picture-supporting frames turn. The revolving frames have suitable apertures and slides for inserting the photographs, and are set in motion by means of a circumferential cog wheel of the last frame, in connection with a pinion turned by a crank or key. The revolving frames are turned one after the other by lugs engaging the adjoining pictures, and suitable spring brakes.

Improved Combined Horse Hoe and Plow.

Albert D. Simons, Windsor, Conn.—In this invention a horse hoe and plow are combined with and attached to a beam of peculiar adaptation to be mounted on a wheel truck for joint or independent action, and so as to be conveniently raised out of or let down into the ground. The machine is intended for plowing and hoeing corn, cotton, and other plants growing in rows, simultaneously on both sides by straddling them, so that the plows and hoes of opposite sides of the machine dress opposite sides of the rows.

Improved Windlass.

Fletcher S. Rowland, Chaplin, Ky.—This improved windlass or hoisting apparatus consists of such an arrangement of the loose and sliding ratchet box with the windlass shaft, and a separate crank shaft and clutch, that the windlass is turned for hoisting in the usual manner; while, for lowering, the clutch connection is released and the descent controlled by the brake action of the ratchet box.

Improved Pantaloon Stretcher.

John D. Ryan, New York city.—This is a device for application to pantaloon, to remove the knee folds and wrinkles that have been formed in them by use, leaving them straight and smooth. In using the device, clamps are secured in the pantaloon. An extension rod is adjusted to the proper length, and its ends are inserted in holes in the bars of the clamps. A swiveled screw is then turned to put the pantaloon under the necessary tension.

Improved Apparatus for Stamping Patterns.

Isidore Rosenthal, New York city.—This stamping apparatus is composed of a cloth-supporting table, with guide pins, and a balanced suspended transfer frame, having the perforated pattern paper stretched thereon, and adapted to be raised and lowered by suitable mechanism. The transfer frame is provided with adjustable intermediate pieces, and clamping top strips, for adjusting and stretching the transfer paper to any width of pattern.

Improved Match Box.

John Knox, Auburn, N. Y.—A slotted shell receives a head which has a groove in one end, and at the other a head, open in the center, to receive an internal cylinder. There is also a side notch to receive a pusher. The cylinder has longitudinal grooves for the matches, and is attached to a swiveled pin in one end, and fastened at the other on an internal projection of the cap. It also has a ratchet, in which works the fixed spring pawl, to prevent it from turning backward. The caps may be removed and the grooves filled with matches, while a further supply may be kept inside the cylinder. A friction spring ignites the match as it is thrown out by the pusher.

Improved Ironing Board.

Eli J. Wolfman, Washingtonville, Ohio.—This invention relates to certain improvements in ironing boards; and it consists in the combination with an encompassing elastic band, of solid incompressible border strips adapted to be forced into grooves in the edges of the ironing board, by means of the said elastic band, for the purpose of holding the cover on more securely, the said solid strips affording three sides which engage with the edge of the cover in the groove with a frictional contact, thereby holding the cover on more securely, and without allowing it to wrinkle, as would be the case with an elastic band alone.

Improved Station Indicator.

James D. Smith, Gregg, N. Y.—A series of flaps are hinged on transverse wires in the middle of the case. By means of stops they are arranged in an inclined position, so that, when released by moving the bar at the upper end of the case, they will fall over by their own gravity, aided by a spring. The bar is attached to a slide, which is confined to the case. By pressing on the long end of a spring lever, the bar will be raised sufficiently to allow the first leaf to drop and admit the next one to the notch, and so on, as the stations are passed.

Improved Chain Propeller.

Clark Smith, Cornwall on the Hudson, N. Y., assignor to himself and William H. Clark, of same place.—This is an improved endless chain paddle wheel, which is so constructed that the paddles may move back and forth between the wheels in straight lines, and this without any sag, and at the same time with very little friction. A series of paddle blocks are jointed together and provided with side flanges, and upper and lower ways provided with top, bottom, and side rows of friction rolls.

Improved Folding Table.

James W. Howland and Della Howland, New Haven, Conn.—Two sections of the table are hinged together at the joint by treble jointed hinges, which are fitted in recesses in the edges of the top below the upper surface, so that the hinges will be hidden when the table is extended. The legs are pivoted to the table in a socketed block, having one wall of the socket removed, so that they can fold down against the table top; and a detachable fastening pin is substituted for the said side, and so contrived that it will fasten the leg both when extended and when folded, thus serving both for a brace and a fastener for holding the leg in the folded condition.

Improved Fumigator for Greenhouses.

Thomas Shaw, Danville, Pa.—In using the machine, the tobacco or other substance to make the smoke is placed in a hopper, and a live coal is placed upon it. A wheel is then turned in such a direction that the fans will draw the air in through the hopper and discharge it, loaded with smoke, through a pipe. In this way the entire greenhouse can be entirely filled with smoke in a very short time. With this construction the device can be placed and operated upon the outside of the greenhouse, the pipe being inserted in a hole formed in the door for that purpose.

Method of Hoisting and Conveying Coal, etc.

George Standiff and Joseph Green, New York city.—This invention consists of a carriage moving on an inclined railway, and provided with fulcrumed lever hooks and cross pin for suspending the bucket thereon. An arrow-shaped suspension rod of the pulley blocks locks over the cross pin of the levers, and is released therefrom by slightly hoisting the hook till it engages a guard plate, which carries the hook below the cross pin without engaging the same. The bucket is tripped for discharging its contents by detaching a latch hook pivoted to its ball, and binding on the rear edge, by means of an adjustable and sliding trip hook, which is pivoted to the carriage, and governed by the hoisting cord of the bucket. The fulcrumed lever hooks are arranged at both ends of the supporting carriage, and constructed with arrow-shaped ends, that lock on pins at end stations that define the length of the way. A sliding weighted cross pin of the station serves to lock the upper hook of the fulcrumed levers on the arrival of the bucket, while the lower hook, arranged nearer to the end of the lever, locks over a lower fixed pin on the detaching of the bucket, being released by the weight of the resuspended bucket, and detached from the station as the upper hook raises the sliding pin, without engaging the same.

Improved Grain Separator.

Wenzel Toepfer, Milwaukee, Wis.—This consists in the combination of an inner brush, its adjustable supporting arms and binding screws, and the vibrating sieve contained with the cylinder, whereby the motion of the sieve is imparted to the brush to give it a longitudinally reciprocating motion. It also consists in an inclined adjustable blade, attached to and moving with a trough for receiving the impurities and conducting them away. A longitudinal brush, with blade and trough, is attached to and moves with the sieve, and is placed along the inner side wall of the cylinder for cleaning the indentations from the impurities gathered therein and carrying them off.

Improved Envelope Opener.

John La Blane and Xavier St. Pierre, Ophir City, Utah Ter.—This consists of a pair of guides projecting from one end of a metal socket piece, adapted to fit over the end of a pencil to form a V groove. At the bottom a little cutting blade projects to cut open the edge of the envelope, which is guided against the blade when the envelope is drawn along between the said guides, or the latter forced along the envelope.

Improved Mowing Machine.

Jason P. Lord, Francis E. Lord, and Orrin E. Lord, Readsborough, Vt.—This mowing machine is so constructed as to greatly diminish the friction in operating it, has no side draft, and will allow the cutters to be taken off one at a time to be ground, or to be replaced with new ones when broken.

Improved Drop-Chute Reverser.

Joseph B. Crowthers, Monongahela City, and William R. Wilkins, Pike Run, Pa.—This invention improves the construction of the drop chutes in common use for loading coal into boats, barges, and other vessels, so as to enable them to be more quickly and more easily reversed than when constructed in the ordinary way, and so as to be conveniently adjusted to correspond with the rise and fall of the water in the river.

Improved Bill File.

Richard H. Hoffman, Keyser, W. Va.—The bottom has three cups, in which are placed conical spiral springs, which bear upward against the table with a constant pressure. The bed is bent upward at right angles with the cups, and then is bent forward and forms the top plate of the file, against which the table bears when the file is empty. Ordinarily the file will rest upon the desk or writing table, standing on the cups. A piece corresponding in form with the lower portion of the bed is attached to the under side of the table, having shallow cups for confining the upper ends of the springs. This plate carries on its back a cross, which works in a slot and holds the table in position.

Improved Fire Tongs.

Lucian Holmes, Tullahoma, Tenn.—The invention is an improvement in the class of fire tongs, whose legs are provided with a guide to prevent their passing each other when opened. The means employed consist of bars pivoted together and to ears or flanges formed on the legs of the tongs.

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Notes & Queries

A. F. K. will find a description of a breech-loading cannon on pp. 149, 402, vol. 27.—A. S. H. will find that galvanizing cast iron is described on p. 59, vol. 24.—D. G. & S. will find directions for annealing steel on p. 107, vol. 29.—A. R. N. can tan buffalo hides with the hair on by the method described on p. 59, vol. 29.

(1) A. R. C. asks: 1. Will copper (such as the bottoms of wash boilers or tea kettles are made of) do for a boiler to run a small engine? I want it to run for 6 hours and be heated by kerosene. A. A boiler to run an engine of this size, and do any work, could not conveniently be heated by a kerosene lamp. It may be made with a central flue, using charcoal as fuel. 2. How low can water be safely in a boiler? A. It is well to set the gage cocks so as to keep the boiler at least half full of water.

(2) A. T. W. asks: 1. What is meant by the pitch of a propeller? A. The pitch of a propeller is the distance it would advance in one revolution, if it turned in an anyielding medium, like a screw in a nut. 2. Is a cylinder 12 inches large enough to run a boat three feet long and about the same proportions as the Mab, described in your issue of March 20? A. Yes. 3. Of what dimensions should I make the boiler? A. About 12 inches in diameter and 15 inches high. 4. Could I run a larger boat with the above mentioned diameter? A. Yes, one twice as large.

(3) E. L. asks: How can I remove oil or grease spots from a wooden floor? A. In some cases, it can be washed out with a solution of potash; but generally you must take out the board to take out the stain.

Is the following rule for finding the number of feet of board that can be sawn from a log correct? From diameter in inches deduct 4, multiply the remainder by 1/4 of itself, and multiply that product by the length of the log, and divide by 8. A. There is no rule so far as we know that is applicable to all cases.

(4) J. M. says: 1. My engine cylinder is 1 1/2 x 2 1/4 stroke, steam pressure 25 lbs., speed 150 revolutions per minute. What is its power? A. We suppose the engine is working at about 1/4 of a horse power. 2. Would a boiler of cylindrical form, with 6 flues, and a furnace of 1/2 inch wrought iron, so attached that the heat can pass under the boiler and return through the flues into the stack, do for engine use? A. Such a furnace would be apt to burn out. 3. What is a test tube, and how is it made? A. It is simply a glass tube closed at one end.

(5) J. E. R. asks: What is the most effectual way of keeping chickens clean and free from vermin? A. Rub upon the roosts, once in every 3 weeks, a little coal oil. Never set the hens on nests that have been used much. If the little chicks are affected, a drop of lard upon each head has been highly recommended; or a weak solution of carbolic soap can be used on their heads, which will completely exterminate the pests.

(6) W. H. says: I noticed in the SCIENTIFIC AMERICAN of February 20, 1875, a recipe for giving an oaken color to pine (coppers, dissolved in strong lye). I did not know what kind of lye, so I slaked some lime, taking the water (after it had settled) to dissolve the copper, and applied with a brush. It was a failure. I tried potash, with no better result than to destroy a nice new brush. All this experimenting was on a new table, which my wife used to sprinkle the family washing upon. The result was that wherever a wet spot touched the table it has turned it yellow, and stained the goods with yellow spots. What is the remedy? A. Strong potash lye, or a concentrated solution of potash in water, was what is meant in the recipe. We understand you to say that you attempted to dissolve copper in the lye, whereas the recipe distinctly

said coppers, which is otherwise known as green vitriol or sulphate of iron. The wood should be steeped in the solution; and when the desired color is obtained, it should be thoroughly washed in water, dried, and varnished with shellac in alcohol. If you will send us particulars as to what you used on your table, whether solution of copper or iron, we will endeavor to help you to remove the stains from your linen.

(7) C. W. asks: If a rifle ball be shot into a two inch oak board so as to penetrate it, and the gun reloaded with the same amount of the same sized powder, and fired up into the air perpendicularly, when the ball comes down, would it penetrate a two inch oak board? A. It would not, as the resistance of the air would decrease its velocity.

(8) P. asks: 1. What is the essential difference between the Hirsch and Griffith screw propellers? A. The two screws differ from each other in the form of the blades and the variation of pitch. 2. What pitch should a 5 feet three-bladed wheel have to give the best results? A. A common proportion would be to make the pitch 8 feet. 3. What would be the percentage of slip? A. With a well designed boat, there would probably be from 15 to 20 per cent of slip.

(9) B. W. asks: 1. What is the exact variation of the magnetic needle in the latitude of Wilmington, N. C.? A. We do not know that this information is published; but by writing to some of the officials of Wilmington, you may get your question answered. 2. How can I test the polarity of my compass? A. By finding a true meridian, from observation of the sun or a star. You will find a method explained in another column of this issue.

(10) H. R. W. asks: How much mixed paint will it take to the square of 100 feet surface on outside work? A. According to Trautwein, the first coat of paint will take 6 1/2 lbs. to the square of 100 feet, 3 1/2 lbs. to the second coat, and 2 1/2 lbs. to the third coat and each subsequent coat, the paint being white lead, and weighed before thinning.

(11) H. C. L. asks: If I were riding in a car going in an easterly direction at the rate of 30 miles an hour, and wanted to jump off, which would be the proper direction for jumping? A. We do not think it would make much difference which way you jumped from a car going at that rate of speed.

(12) L. W. J. asks: I have a small engine, of 1 1/2 inches bore, 3 inches stroke. What would be the most appropriate style of boiler to run it with? A. You can make an upright boiler, with a flue in the center. Diameter of shell, 15 inches; diameter of flue, 4 inches; height of boiler, 30 inches.

(13) F. K. says: We have, for the purpose of reducing large lumps of coal into smaller, 3 sets of rolls or cylinders, studded on their peripheries with points or teeth; these have become dull in time and we desire to resharpen them. The cylinders and teeth are made of cast steel, and to chip them is a tedious and imperfect process. Can we not generate a gas, conduct it to the tooth to be sharpened, heat it sufficiently, and hammer out the point? A. We believe that you could effect it better by the use of emery wheels, which could readily be arranged to do the work. If you wish to heat the points, however, we presume you could do it most readily by the use of a blowpipe of proper construction.

(14) J. W. A. asks: In my engine, the area of plate or valve is 12x12 inches, pressure in steam chest is 100 lbs. per square inch. What amount of power is necessary to slide the plate or valve on a blank surface, the two surfaces having been planed and scraped as valves and seats are usually done? The opening under the valve in the valve seat is 1x10 or 10 square inches in area. What is the amount of power necessary to move or slide the valve covering the above opening? Which of the two above mentioned will require the least power to slide it on its respective seat? A. The power will be the same in each case, if, as we understand you to mean, there is no upward pressure on either valve.

(15) W. H. S. asks: 1. What is the value per cubic foot of charcoal, compared with soft bituminous (Iowa) coal, and with hard wood, for firing a steam boiler? A. Coal, charcoal 1/2, wood 1/2. 2. I have an engine with a rotary or rock cut-off valve. With 100 lbs. pressure, doing heavy work, I occasionally found the valve to grate immediately after putting on tallow, which grating generally lasted about five minutes. I tried lard oil and castor oil with the same result. I tried sulphur and tallow, when the valve worked very satisfactorily. I worked it about five weeks with sulphur and tallow, and found the cylinder was worn 1/4 of an inch larger at the middle than at the end. Did the sulphur have anything to do with it? The valve seat, cylinder, and rings are very smooth and bright. A. It is more likely that the trouble was caused by some lack of proper adjustment.

(16) C. R. B. asks: Why is it that the yolk of an egg cannot be beaten as stiff as the white? A. It is due to the fact that a large proportion of the yolk is composed of oil.

(17) O. C. B. asks: 1. I have a boiler 20 inches high by 15 inches diameter, with 27 tubes. Boiler is of 3/4 inch cast iron, with heads of 1/2 inch cast iron. How much steam would it be safe to carry? A. We would not advise you to carry a pressure of more than 15 lbs. in such a boiler, and we think it would be much better to build one of wrought iron or copper. 2. How large an engine would it take to run a small lathe, 24 inches long, at 600 revolutions per minute? A. Diameter of cylinder 1 1/2 inches, length of stroke 3 inches.

(18) H. S. M. says: I was recently consulted by a friend who is about to enter into the manufacture of a combined ice chest and refrigerator

in which he intends to substitute mechanical force for the usual daily supply of ice, that is, he intends to form ice in the chest by mechanical action, the motive power being a man operating, through a crank or lever, a small ice machine contained in the chest itself. The machine is to be of the ether type, in which a quantity of some very volatile liquid is made to boil in a partial vacuum. I was asked: How long will it take a moderately strong man to make 10 lbs. of ice from 10 lbs. of water at 70° Fah., providing that the apparatus be as nearly perfect as possible? I computed it as follows, and my clients of opinion that I am wide of the mark: 10 lbs. water will have to be relieved of 35° Fah. of its latent heat to reach the freezing point; and as 1 lb. of water heated 1° constitutes the unit of heat, hence 10x35=350 units of heat which have to be taken out of the water before ice forms at all. Then again, on the water passing from a liquid to a solid form, it will set free 140 units of heat for each pound of ice formed, and at the same time remain at the same temperature itself. Therefore 140x10=1,400, and 1,400+350=1,750 units of heat to be converted into mechanical force and converted back into heat in the condenser of the machine; and as every unit of heat has a mechanical equivalent equal to raising 772 lbs. 1 foot high, we have 772x1,750=1,374,100 foot pounds, which, being divided by 33,000, gives 41.63, or the number of minutes during which 1 horse power is required to raise 1,374,100 lbs. one foot high, or to reduce 10 lbs. of water from 70° Fah. to ice; and as it requires seven men to exert 1 horse power constantly, it will require one man seven times as long; therefore 41.63x7=291.41+60=451.41 hours as the time that one man would be required to work the pump to produce 10 lbs. of ice. To this must be added 25 per cent for friction and absorption of external heat, which brings the sum total up to 605 hours. Am I right? A. The calculation is correct for the theoretical time, and is very creditable to you. It is probable, however, that still greater allowance must be made for friction, leakage, radiation, etc., than the one you have estimated.

(19) C. D. asks: By what process can I produce crystallized effects, such as we see on water coolers? A. It can be done by mixing ground mica with collodion, and applying to the surface.

(20) E. S. F. says: 1. We purchased some woodworking machinery which has been standing still for some time, and consequently has become gummed. Will kerosene oil be as good as anything to remove the gum, or had the machines better be taken all apart and cleaned? A. It will be better to take the machinery apart. 2. Will kerosene injure the journals and boxes if put on when we commence running? A. Kerosene oil will not injure the journals, but the dirt and grit on them may if you start up the shafts before cleaning them.

(21) C. F. S. asks: How do you explain the fact that water, being placed in a cellar in an open vessel, will keep vegetables from freezing? It has been done here this winter with success, protecting apples and potatoes from frost. A. If you will give us further particulars we will investigate the matter. We do not think the presence of the water was the preventive.

(22) H. B. says: We are making a quantity of cast iron augers, about 12 inches long and from 4 to 8 inches diameter at the outside of threads. The threads are about 1 1/2 inches apart and of about the same depth. We wish to polish these with an emery belt, having first removed the rough exterior by an emery wheel. Is a leather or rubber belt best? What kind of glue is best? A. Use leather and ordinary glue of good quality.

(23) D. B. C. Jr. says: 1. I wish to build a light boat, 30 feet long by 7 beam, to draw 12 inches water. Please give me the size of boiler, engines (for side wheels), diameter of side wheels, length and depth of buckets. A. Engine 4x6 inches, and boiler 3 feet diameter and 4 feet high. 2. Which would be the best, a side wheeler or a propeller for a stream with a rocky bottom? A. It will be best to have a propeller, or twin screws.

(24) D. W. W. asks: 1. What is the difference between plumbago and black lead? A. None. Is the mineral known as fibrous asbestos good for packing piston and valve rods on steam engines? A. Yes.

How can I make a brown or black enamel or paint, for cylinder heads and steam chests, which will not crack and scale off as common paint does? A. There is a black varnish made from mineral oil that answers very well. See p. 379, vol. 31.

(25) J. C. Jr. says: I have a steam engine and wish to know if you can inform me why the boiler foams. I fancy that the steam pipe is too small, or possibly the boiler itself may not be large enough for the engine. The builders say that, after she has been two or three months running, she will come all right; but I find she has not improved after an experience of six weeks. A. The trouble is probably caused by dirty water. If so, blow off frequently, and clean the boiler.

(26) H. M. D. asks: Will you please tell me how soot may be used to advantage? A. Wood soot may be used as a fertilizer.

How may I get rid of the grub worm from trees and bushes? A. Dig down about the base of the trunk about 12 inches, and incase it snugly with tarred paper to about one foot above the surface of the ground; then fill in the soil.

What are the ingredients of nitro-glycerin? A. It contains carbon 3 equivalents, hydrogen 5, nitrogen 3, oxygen 9, =C₃H₅N₃O₉.

(27) I. W. S. asks: If I insert a platinum wire into a U-shaped tube, fill the tube with a mixture of oxygen and hydrogen, place the mouths of the tube in a vessel of water and connect the ends of the wire with the poles of a battery, will

the tube be broken when the combination of the gases takes place? A. If the tube be a strong one, and has large openings at the mouth, it will not.

How can I make a paste or mucilage which will dry quickly, and not make the paper curl up? A. Use a solution of pure gum arabic in warm water, and mix a little refined sugar with it.

(28) G. A. Z. says: I am working an improvement on the common smoking pipe, and have to use some metal inside the bowl, in contact with the burning tobacco. Would brass be injurious to the smoker? Would nickel be more suitable? A. Nickel or nickel-plated brass would be the better for this purpose.

(29) G. B. B. asks: In your formula for amalgam for silvering hollow glass vessels, etc., what quantities of lead and tin are meant? A. Melt together 1 oz. clean lead and 1 oz. fine tin in a clean iron ladle, then immediately add 1 oz. bismuth. Skin off the dross, remove the ladle from the fire, and before it sets add 10 ozs. quicksilver. Now stir the whole carefully, taking care not to breathe over it, as the fumes of the mercury are very pernicious. Pour this through an earthen pipe into the glass globe, which turn repeatedly round.

(30) R. S. S. asks: Is there any advantage in having the brake block in front of a wheel, or would it have as much power over the wheel if placed behind? A. There would be little, if any, difference.

(31) B. C. & Co. ask: How can I separate tin from dross? A. The tin is melted and the temperature raised very considerably in order to render the slag as liquid as possible, so that it may not retain too much tin with it. It is also necessary to stir the melted mass in order to facilitate the separation of the tin. The clay is then raked out, and the melted tin run into a cast iron pan: where it is allowed to remain for some time, in order that any slag may rise to the surface; after which it is skimmed, and poured into cast iron molds.

(32) E. F. H. asks: 1. Which are the best metals for large stencil plates? A. Thin hard brass is the best for this purpose. 2. Can acids be successfully used for this purpose? A. No.

(33) S. R. C. asks: In dyeing with aniline colors, what can we use to set the dye on cottons, woollens, and silks? A. Perkin uses tannin as a mordant for fixing the colors upon cotton and calicoes, working in an acid solution of the coloring matter. A basic lead salt may also be used as a mordant. In calico printing, the colors are usually mixed with albumen, which, by coagulation with steam heat, fixes the color on the fiber. Wool takes aniline dyes from their aqueous (but not acidulated) solutions readily at a temperature of 120° to 140° Fah. In the case of silk, all that is necessary is to steep it in the solution (the solvent being either alcohol or wood spirit) until the desired color is obtained.

(34) A. B. R. says: I have had 750 barrels of old cider on hand for three years. How can I turn it into vinegar? A. Add to each barrel a little fermenting substance, such as yeast or mother of vinegar.

(35) W. C. R. asks: I want to make oxygen gas in an iron quicksilver bottle. I want to screw on to it a cock and a nipple, and put a certain amount of chemicals into it, set it on the fire, and make the gas without letting it out of the bottle. In other words, I want to make a self-condensing gas cylinder. What amount of pressure will one of those bottles stand? Will 1 lb. chlorate of potash and 4 ozs. manganese yield too heavy a strain? I put in just half of the above quantities and screwed on the bottle a steam gage. It brought the gage up to 170 lbs., and would have gone higher, but I felt a little timid, and unscrewed the gage, and allowed the gas to escape. The bottle is 12 inches high and 5 inches in diameter, and about half an inch thick, outside measurement. A. As the volume of a gas is inversely as the pressure to which it is subjected, your bottle, with a pressure of 240 lbs. to the square inch, would hold a little over 24 cubic feet. The question is not what pressure the bottle will stand when cold, but with the bottom (in this case) necessarily heated nearly or quite to full redness. And as the rigidity of iron decreases rapidly as its temperature is raised, we are unable to give you the required figures. Your experiment was a very rash one, as many serious and some fatal accidents have occurred, to our knowledge, from like experiments. Besides, so small a quantity of gas (if used for the lime light) would last only a very short time.

(36) G. K. says: I want a cement that will harden in 48 hours or less, to be of the consistence of molasses. It is to be used to cement sandstone under salt or fresh water. A. Use Portland cement.

(37) E. E. S. asks: 1. What should be the relative diameters of the wheel on crank shaft, the pulley on saw arbor, and of the saw, in order to obtain the best effects in a foot power circular saw? A. We could not tell without knowing more particulars; but you will find a number of such machines in use, and you can observe their proportions. 2. Is there any advantage in placing a fly wheel on the saw arbor? A. The use of a fly wheel is advisable with such a machine. To your other question, there is a loss of power in the device you describe.

(38) G. L. N. asks: How can I deodorize kerosene oil? A. Digest it with chloride of calcium. This will leave it with a pleasant ethereal odor.

(39) L. D. M. asks: What can I size paper with, to prevent lard oil from striking through? A. Try dammar varnish.

1. What are the extra currents of electricity?

A. If a closed circuit traversed by a voltaic current be opened, a scarcely perceptible spark is obtained, if the wire joining the two poles be short. Further, if the observer himself form a part of the circuit by holding a pole in each hand, no shock is perceived unless the current is very intense. If, on the contrary, the wire is long, and especially if it makes a great number of turns, so as to form a bobbin with very close folds, the spark, which is inappreciable when the circuit is closed, acquires a great intensity when it is opened, and an observer in the circuit receives a shock, which is the stronger as the number of turns of wire increases. 2. What causes the electric light, and why can it not be used for illumination? A. The heating of the poles is due to the great resistance which the electric current encounters at these points, the carbon composing which is converted into vapor by the intense heat, forming a conducting bridge across the gap, over which the luminous transfer of electricity takes place. 3. How does the core of an induction coil affect the induction current? A. It induces a current contrary to that passing in the primary wire at every breaking of the latter, which comes under the head of extra currents, explained above. 4. Has there ever been patented an automatic repeater with simply two relays? A. We think not.

(40) E. A. W. asks: What is absinthe? A. A cordial of brandy, flavored with wormwood.

(41) R. G. asks: Can you give me a practical recipe for manufacturing potash? A. Caustic potash is generally procured by the action of caustic lime in a boiling solution of carbonate of potash. The lime unites with the carbonic acid of the potash, forming insoluble carbonate of lime, which subsides. The clear liquid, containing the potash in solution, is then drawn off and concentrated by evaporation. If the heat be continued to a point little short of redness, the liquid flows without ebullition, and may then be run into molds, where it solidifies on cooling, forming the small, grayish white sticks of commerce. The vessels used are either iron or silver.

(42) T. S. R. asks: Does it require more power to run a four-blade propeller than a two-blade, the size being the same? A. Yes.

What is the best for an engine making 300 revolutions per minute, the propeller being 28 inches in diameter, and the engine 3½x5 inches? A. The four-bladed screw will utilize most of the power.

(43) W. M. asks: What ingredients will prevent the explosion of coal oil, and not impair the light when used in lamps? A. We can give you no better recipe than that of distilling off the lighter portions of the fluid until the specific gravity of the remaining portion is about 0.75 to 0.80.

1. How can I clean and polish window panes, mirrors, etc.? A. Take a small soft sponge, well washed from everything gritty, just dip it into water and squeeze it out again, and then dip it into some spirit of wine. Rub it over the glass, which immediately dries over with whitening sifted through muslin; rub it lightly and quickly off with a cloth, then take a clean cloth and rub it well again, and finish by rubbing it with a silk handkerchief. 2. How can I clean lacquered frames? A. Use a soft sponge and warm water. For paints, use soap and water. 3. How can I clean plated ware? A. Clean with hot water, followed by a solution of equal parts of spirits of ammonia and turpentine; and after this, if necessary, prepared chalk, whiting, magnesia, or rouge.

(44) F. E. M. asks: 1. What proportion to the periodic time of the heavenly bodies would be the time in which they would fall to the center of force, supposing the tangential force suddenly destroyed? A. The planets will reach the sun with the same velocity spirally as if they fell direct. 2. If two masses, each of which would attract to its center a body in one second at the distance of one foot, be placed two feet apart, would they meet in one second? A. No; they would meet in two seconds. 3. Professor Tait in *Good Words* speaks of the tridimensional character of space, and he mentions that mathematicians have speculated upon a fourth dimension. What mode is alluded to? A. This speculation reaches to serene heights where mathematics become lost in metaphysics and fog.

(45) M. C. R. asks: 1. How can I make an electromagnet? A. Wind insulated copper wire around the two ends of a bar of soft iron, bent into the form of a horseshoe. 2. About what weight would a magnet made of 10 lbs. wire be capable of raising, and what size of wire is the best? A. Coarse wire is the best for making magnets if the object is to raise heavy weights. The question as to how much a magnet containing 10 lbs. wire would be capable of raising could not be properly answered without stating how much battery is to be used.

(46) D. L. M. asks: 1. What is the difference between clock time and mean solar time, and why is there such a marked difference at particular times? A. The equation of time is the difference of the sun's true right ascension and mean longitude. 2. Is the direction of the earth's axis to its orbit always in the same direction? A. The direction of the earth's axis is nearly uniform.

(47) L. E. O. asks: Will an anode composed of nickel five cent pieces answer for nickel plating on a small scale? A. Yes.

(48) G. C. P. Jr. asks: 1. What is the best way to make a solution of rubber? A. By far the best solvent for rubber is bisulphide of carbon. 2. Is it safe to heat naphtha over a spirit lamp to boiling heat? A. No; the naphtha may be heated by immersing the vessel containing it in hot water or hot sand. This had better be done in the open air.

1. What is the best method to adopt in order to polish amber tortoiseshell? A. Use putty powder. 2. When is faded, can it be restored to its natural color? A. It cannot.

Of what is fool's gold composed? Is it of any value? A. It is a compound of iron and sulphur, Fe S₂, and is of considerable value as a source of sulphur in the manufacture of sulphuric acid.

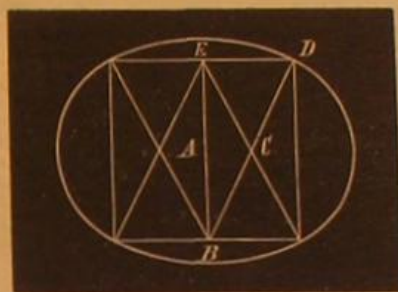
(49) C. D. H. asks: 1. In the construction of an induction coil 3 feet long, is it better to use a number of iron wires or a bar of iron for the core? A. Use a bundle of iron wires. 2. How large should it be? A. As long as the coil. 3. What size of copper wire should be used in the primary and secondary coils respectively? A. No. 4 in primary and No. 36 in secondary. 4. How should each be insulated? A. Cotton for primary and silk for secondary. 5. What is the best material for ends of the coil? A. This is immaterial. 6. What amount of battery would be required for a specific length of spark? A. Six cells will give a ten inch spark. 7. Would it do for an electric light? A. No.

(50) C. W. asks: 1. How can I make water colors in small cakes? A. Mix the colors into a thick paste with hot water containing a little gum arabic, and press into molds. 2. How can I make plumbago or black lead into cakes? A. Where pieces of sufficient size are obtainable, they may be sawn into the required shape. When in powder, it may be incorporated with a very small quantity of melted sulphur, or moistened with water and subjected to great pressure, when it coheres.

(51) W. L. D. asks: How can I make the linking rings which sleight of hand performers use? A. We are not acquainted with the manner in which these tricks are executed.

Can a person charge himself with electricity? A. Yes, by means of an electrical machine.

(52) H. C. N. says: I believe that the following method of drawing an oval is superior to many, and it draws a perfect oval. Take any



square, bisect it, and draw diagonals in the halves of the square. Describe the oval with the compass, using A, C, B, and E as centers.

(53) E. O. M. says: If N. P. B. will use the tang of an old mill saw file, he can turn his grindstone off true. When one side of the tang wears out, turn it over.

(54) T. W. D. says, in reply to J. H., who asked for a process in which to dye the skins of small animals, such as muskrat, mink, etc.? The green hull of the European walnut is turned to account in Europe for dyeing furs black, and the hull of our black walnut could probably be similarly employed. The walnut hull is crushed and the juice squeezed out from the pulp, with the addition of a little water. A small quantity of lime is added, and the dye is ready for use. The color is extremely difficult of extraction, and attaches itself very readily to any kind of hair, and it is used extensively as a hair dye. The coloring matter consists essentially of a soluble alkaloid lately investigated and known as reganine.

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

F. F. H.—The tin has been acted upon by nitric acid of proper strength. The mineral is iron pyrites.—E. P. C.—It is black oxide of iron, mixed with quartz. It has too small a percentage of iron to be used as an ore.—G. S.—It is graphite or plumbago.—R. W. T.—It is iron pyrites, and (unless you find it in large quantities) cannot be made use of.—Y. M.—It is mispickel, and contains arsenic 46 per cent, sulphur 20 per cent, and iron 34. If you heat it strongly, the arsenic will be driven off with a disagreeable smell, and a piece of magnetic oxide of iron will remain.—A. E. J.—It is a secretion of carbonate of lime, and has no value.—J. D. B.—It is iron pyrites.—F. A. M. and O. E. F.—No. 1 is altered scapolite. No. 2 is white talc. No. 3 is aragonite. No. 4 is marcasite, or white iron pyrites. No. 5 is galena. No. 6 is asbestiform talc. No. 7 is a variety of talc. It may be used as a lubricant or to extract grease, or (when soft enough) as a French chalk. No. 8 is compact talc. No. 9 is talc. No. 10 is tremolite. No. 11 is ferruginous quartzite. No. 12 is chrysotile imbedded in volcanic tuff. No. 14 is iron pyrites in granite. No. 16 is an altered and decomposed pyroxene. No. 17. It is difficult from so small a fragment to decide whether it is pyrite or cobaltite. No. 18 is cupiferous amygdaloid. No. 19 is yellow oxide of iron. No. 20 is compound crystals, containing the cube, octohedron, and rhombic dodecahedron of iron pyrites.—I. F. D.—Nos. 1 and 2 contain some sulphuret of mercury, along with iron pyrites. From Nos. 3 and 6 we obtained no indications. No. 4 contained some iron pyrites in quartz; whether anything else were present could not be determined from the smallness of the amount.—G. C. R.—Both samples consist mostly of siliceous, with some alumina. The darker specimen was colored with oxide of iron. They both contained phosphoric acid, No. 2 having the larger percentage; and any fertilizing qualities which they possess are due to the presence of this constituent.—J. O. B.—No. 1 is magnetite, with some vitreous quartz, soda, felspar, and magnetic oxide of iron. No. 2 is lime, magnesia, and garnet. No. 3 is orthoclase. No. 4 is oligoclase. No. 5 is hornblende.—D. K.—Nos. 1 and 4 are sulphuret of iron in quartz and pyroxene. No. 2 is not an iron ore. It is a silicate of alumina,

lime, and magnesia, with some oxide of iron, but not sufficient for extraction. No. 3 shows shining scales of biotite, a variety of mica, and the remainder is a mixture of quartz and felspar. No. 5 is not metal, as you say. It is a partly reduced sulphuret of iron, exceedingly brittle from presence of excess of sulphur.—H. W. F.—It is pyrrhotite or magnetic iron pyrites, and contains 39 per cent sulphur, 60 of iron, and traces of manganese and nickel.—F. M. S.—It is galena or sulphuret of lead, and contains 85 per cent of metallic lead.—E. J. M.—These specimens consist of carbonate of lime, and may have come from the skeleton or shell of some animal.

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 New Numerical System. By F. E.
On the Sun's Orbit. By J. H.
On Stationary Engines. By J. C. G.
On the Current Worm. By C. T.

Also enquiries and answers from the following:

F. F. M.—R. H. S.—J. T.—F. H. W.—N. B. D.—
R. K. W.—J. T. P.—N. F.—R. S. W.—N. W. H.—
F. H.—N. K.

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 enquiries analogous to the following are sent: "Who makes good washing machines? Whose is the best knife-cleaning machine? Who sells battery carbons? What are the prices of terrestrial globes? Whose is the best hominy mill? Who sells the best bone-crushing mill?" 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.]

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April 6, 1875,

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APRIL 1 to 9, 1875

4,553.—J. Borer, West Flamboro, Ont. Cultivator. April 5, 1875.
4,559.—W. S. Tarrie, Moncton, N. B. Soap. April 5, 1875.
4,560.—F. Rourk, Montreal, P. Q. Ventilating sawers and mines. April 5, 1875.
4,561.—Wm. T. Root et al., Ingersoll, Ont. Boiler magazine. April 5, 1875.
4,562.—G. McEwan, Derby, Vt., U. S. Milk pan discharge tube and stopple. April 5, 1875.
4,563.—G. A. Beldier, Philadelphia, Pa. U. S. Lamp burner. April 5, 1875.

4,564.—W. H. W. Sheppard, Newmarket, Ont. Heating stove. April 5, 1875.
4,565.—J. W. Beaumont, Petrolia, Ont. Artificial coal. April 5, 1875.
4,566.—F. P. Peace, Marysville, Tenn., U. S. Breech-loading fire arm. April 5, 1875.
4,567.—L. M. E. Raveaud et al., New Orleans, La., U. S. Heating stove. April 5, 1875.
4,568.—W. J. Wilson, Chicago, Ill., U. S. Preserving and packing cooked meat. April 5, 1875.
4,569.—L. Coté, St. Hyacinthe, P. Q. Heel stiffener shaping machine. April 5, 1875.
4,570.—G. W. McCready, Petrolia, N. B. Perpetual calendar and pen holder. April 5, 1875.
4,571.—F. M. Willson et al., Hamilton, Ont. Lamp holding attachment for sewing machine. April 5, 1875.
4,572.—A. Woods et al., Liverpool, England. Life saving appliance for sea use. April 5, 1875.
4,573.—J. Forsyth, Dundas, Ont. Mower and reaper lifter and clutch. April 5, 1875.
4,574.—I. H. Hayes et al., Manchester, England. Self-adjusting umbrella. April 5, 1875.
4,575.—H. B. Arnold, Dresden, Ont. Combination bed lounge. April 5, 1875.
4,576.—H. Taylor, Richmond Hill, Ont. Lamp. April 5, 1875.
4,577 and 4,578.—C. D. Bigelow, Brooklyn, N. Y., U. S. Screw soiling machines. April 6, 1875.
4,579.—H. Wandby, Toronto, Ont. Gypsum kiln and baker's oven. April 6, 1875.
4,580.—J. B. McCormick, Armagh, Pa., U. S., et al. Turbine water wheel. Small capital required. Address HOPE MACHINE CO., 121 W. Second St., Cincinnati, O. April 6, 1875.
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4,582.—J. Dryland, Hamilton, Ont. Anti-grease attachment for cooking stoves. April 6, 1875.
4,583.—S. K. Paige et al., Henniker, N. H., U. S. Box machine. April 6, 1875.
4,584.—J. T. McNally, Brooklyn, N. Y., U. S. Bran picker and duster. April 6, 1875.
4,585.—J. S. Bonter, Blairton, Ont. Quilting frame. April 6, 1875.
4,586.—E. Horsey, Kingston, Ont. Pump. April 8, 1875.
4,587.—P. Nicolle, Lindsay, Ont. Beehive. April 8, 1875.
4,588.—B. H. Davis, Foxcroft, Me., U. S. Stump and rock lifter. April 8, 1875.
4,589.—T. N. Egery, Bangor, Me., U. S. Water wheel. April 8, 1875.
4,590.—S. J. Lundy, Uxbridge, Ont. Plow protecting draw clevis. April 8, 1875.
4,591.—E. D. Reynolds et al., Brockton, Mass., U. S. Bag. April 8, 1875.
4,592.—F. Dagenais et al., Montreal, P. Q. Rock drill. April 8, 1875.
4,593.—J. Batterby, Ingersoll, Ont. Portable steam boiler. April 8, 1875.
4,594 and 4,595.—A. Dick et al., Hamilton, Ont. Signal light and head lamp for railways. April 9, 1875.
4,596.—D. McLellan, Charlottetown, Ont. Sap evaporator. April 9, 1875.
4,597.—A. V. M. Sprague, Rochester, N. Y., U. S. Combination ice tool. April 9, 1875.
4,598.—G. P. Simmons et al., Cambridge, Mass., U. S. Quilting and mat frame. April 9, 1875.
4,599.—F. M. Goodhue, Freeport, Ill., U. S. Windmill. April 9, 1875.
4,600.—A. Bowman, Blair, Ont. Railway. April 9, 1875.
4,601.—Wm. McKay, Ottawa, Ont. Silicated metallic paint. April 9, 1875.
4,602.—R. D. Van de Carr, Rochester, N. Y., U. S. Clock caddy or case. April 9, 1875.
4,603.—S. Snell, Watertown, N. Y., U. S. Straw and barley fork. April 9, 1875.
4,604.—A. H. Hornsby, Chicago, Ill., U. S. Extension arm chair. April 9, 1875.
4,605.—T. Hawks, Rochester, N. Y., U. S. Brewing process. April 9, 1875.
4,606.—Wm. Ascough, Buffalo, N. Y., U. S. Wrench. April 9, 1875.
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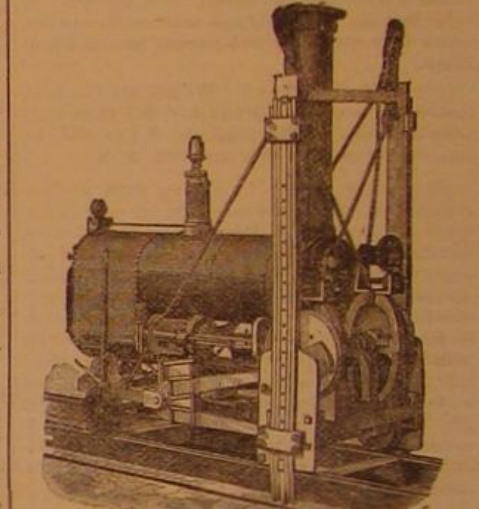
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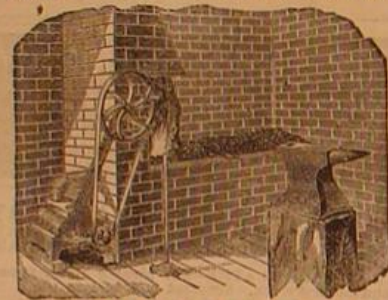
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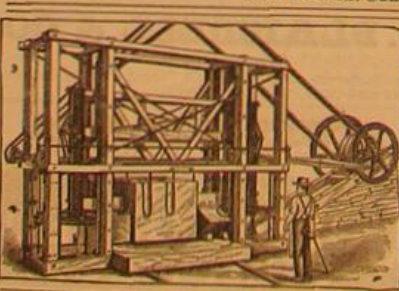
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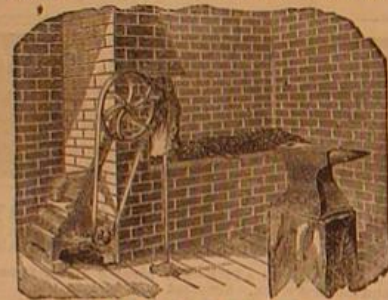
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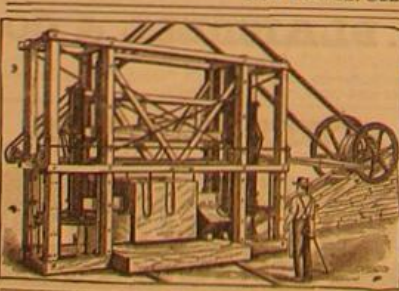
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(NEW SERIES.)

NEW YORK, MAY 15, 1875.

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IMPROVED SHEARS FOR CUTTING BAR IRON.

The ordinary method of cutting bar iron or railroad rails is by means of the cold chisel and hammer, a tedious and at best inaccurate operation, involving the labor of three men and no small expenditure of time. It is hardly necessary to point out that an efficient device for the same purpose would possess considerable economical value; and for this reason, in addition to that of its producing superior work, its substitution for hand labor may be urged.

The subject of our illustration is a power shears, of the size adapted to cut round iron of all sizes up to two inches. It is also provided with blades to cut flat iron as large as one by four inches, and square iron up to one and one half inches, without alteration. The machine is well adapted for the use of chain or bolt makers, and for general machine shop work. Smaller shears are made for lighter work, and larger ones for cutting up old rails and scrap for rolling mills. The size here-with represented, which cuts 2 inch iron, weighs only 2,000 lbs., and occupies a space of 3 by 5 feet on the floor. A hand machine weighing but 470 lbs., worked by two men, we are informed, has repeatedly cut off rails of seventy-two inches sectional area, requiring 360,000 lbs. pressure.

The pressure required to shear off two inch round iron will average 157,000 lbs., and the means whereby so much force is concentrated in so little space, and so much strain resisted by so little weight of cast iron, involves two principles in mechanical construction. The first principle consists in fastening the blades, A, B, and C, of the shears within the circumference, C', of its bearing of oscillation, in such manner that the largest bar to be cut is placed close to the axis or actual center of the shears. This is claimed to secure the shortest possible unit of leverage for the resistance, and at the same time the resistance or strain on the machine is located so near the center as to allow the iron, which must support said strain, to be distributed in a circle. Second, since the work is intermittent, a fly wheel may be advantageously used. And since the power that may be accumulated in fly wheels is proportional to the square of the velocity of their rims, the weights being equal, a good speed to the wheel is the first requisite.

The shears shown has a three feet wheel, weighing 630 lbs., with eight inches face, running 120 turns a minute. As two inch iron cannot be handled to cut chain links faster than 15 or 18 times a minute, the power of the wheel may be multiplied about 8 times, by such mechanism as will give the shears blade 15 strokes to the wheel's 120 turns.

In this machine the power of the fly wheel is communicated directly to the moving arm of the shears, by means of an eccentric, D, on the hub of said wheel, driving a pawl, which engages teeth in a circular arc, E, at the outer end of the shear arm, F, thus raising said shear arm one tooth at each revolution of the wheel, an attendant pawl, G, supporting the arm by each tooth as it rises. A stop dog, H, which may be fastened between any two teeth, on arriving beneath the pawls, disengages them, and the shear arm drops back to its normal position, where it is received on a cushion, I, to avoid noise.

Thus, by dividing the angle, through which the shears must move to cut two inch iron, into 8 teeth, and by placing said teeth far enough from center so that each tooth may be thick enough to bear its load with safety, the whole problem,

the inventor claims, is solved with light parts, and almost no power wasted in friction. The eccentric is so proportioned to the teeth that the fly wheel is at work only one quarter of each turn, leaving three quarters of the working time and all the time between work for it to accumulate power. The body of the machine has a trunnion projecting

For bolt and chain makers, a gage is supplied, that regulates the length of the piece cut, with precision. And this gage has a very ingenious mechanism, whereby the very act of pushing the bar against it starts the machine. The notches made in the blades for cutting round iron are so arranged as to cut the smallest iron at the farthest point from center, thus requiring only the motion of one tooth. Allowing a little time for the arm to fall, the shears will cut 100 pieces of one half inch iron, 75 pieces of three quarter, 50 pieces of one inch, or 15 pieces of two inch iron in one minute, while the fly wheel continues at the speed of 120 turns per minute. Its great firmness causes the blades to wear a long time. An opening from the joint allows the scale and rust to fall out.

These machines, we are informed, have proved by use to be very efficient, reliable, and extremely cheap, as their first cost is not one half that of other shears capable of the same grade and amount of work. The principal features of these shears are soon to be adapted to a combined shears and punch for boiler plate work. The device has been patented in the United States, Canada, Great Britain, France, Belgium, and Austria.

For further information, address the inventor and manufacturer, W. X. Stevens, East Brookfield, Mass.

A Railway on the Sea Bottom.

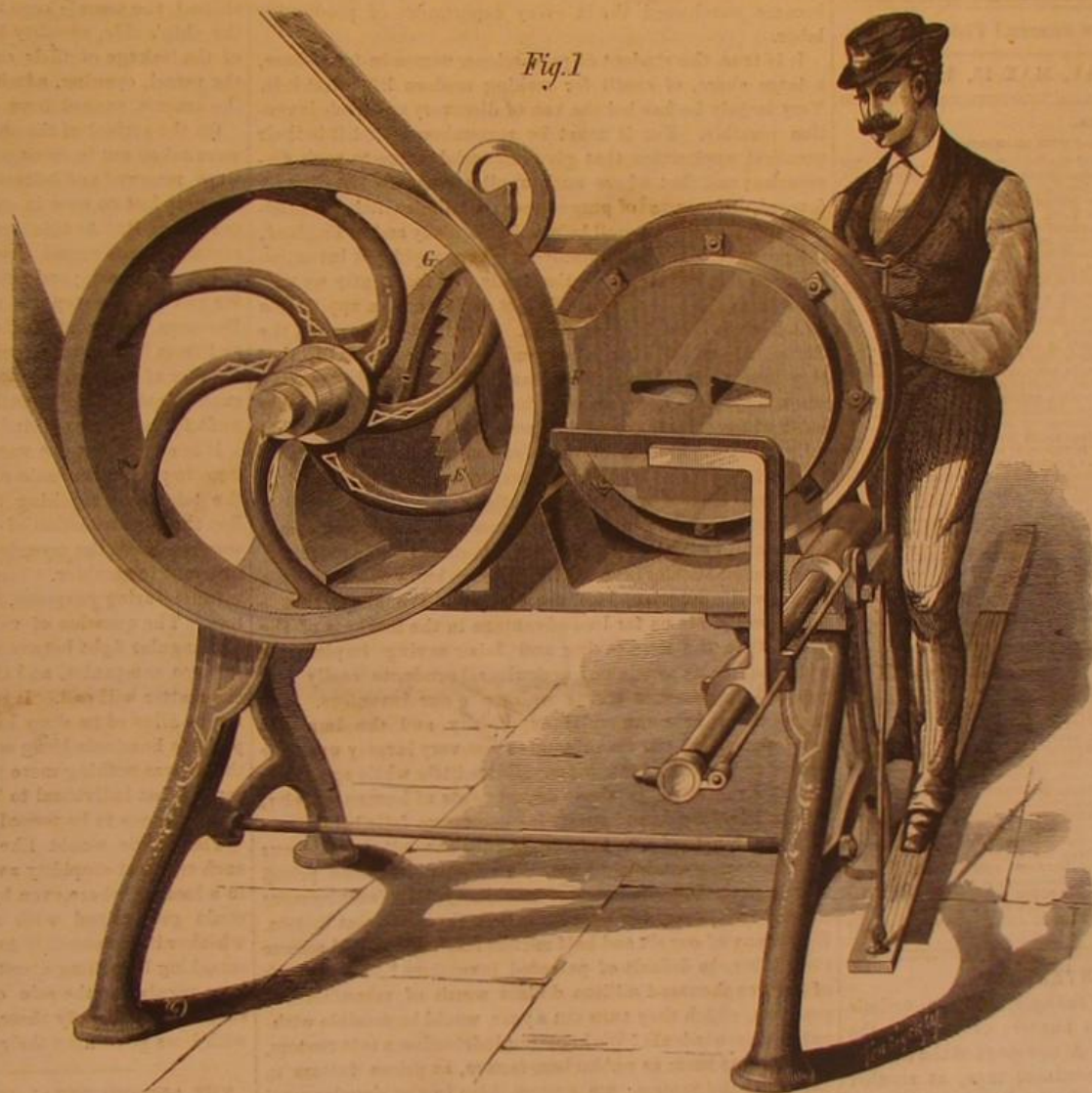
Dr. Lacomme's project might, perhaps, be termed more fittingly a marine railway, or a railway for the marines. He proposes to lay a submarine line of rails at the bottom of the Straits of Dover between England and France, upon which a weighted chariot or platform is to run, and upon this platform is to be placed a submarine boat, composed of galvanized iron, and hermetically sealed, propelled by compressed air.

Steel Rails.

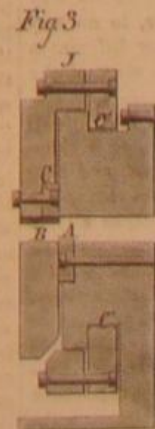
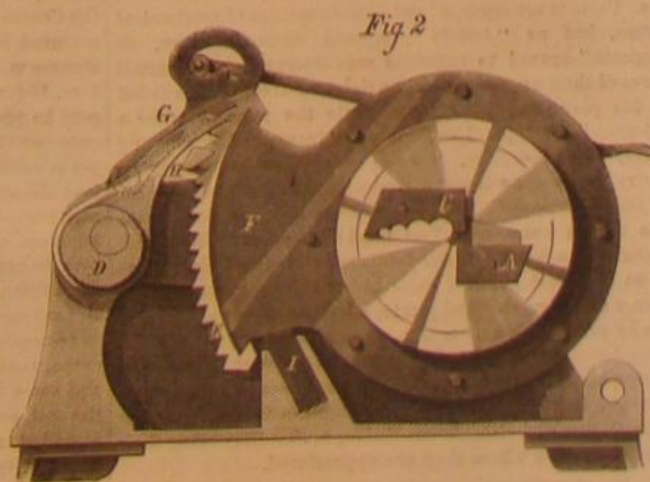
We had a conversation with the president of one of our largest railroads the other day, in which he said, speaking of the relative merits of steel over iron rails, that he believed that it was better economy for any railroad doing a large traffic to pay the present price for steel rails than to lay down iron, even if the latter were delivered free of cost. We thought at the time that the assertion was pretty strong; but on inquiry among other practical railroad men, they confirmed the first gentleman's assertion.

A recent number of the *Railroad Gazette* contained an engraving representing the wear on a steel rail, laid down in 1865, on the single main track in Clark street, Chicago, where nearly all the trains of the Chicago, Rock Island, and Pacific and the Lake Shore and Michigan Southern railroads passed over it, and where engines were constantly shifting. Iron rails in similar positions were renewed as often as once in six months, the steel rails having outworn sixteen of the iron rails. The steel rail was gradually worn down on one side, but there was no splintering, as in iron rails.

It will be observed, on reference to the list of Canadian patents published in these columns weekly, that the number of patentees is largely increasing. The last week's issue numbered forty-eight. In the corresponding week of last year, only half this number was issued.



STEVENS' IRON-CUTTING SHEARS.



from its face, on which is a circular flange, behind which a collar, J, takes a facial bearing. The moving arm, F, containing one pair of steel shear blades, B, has its bearing of oscillation on the circumference of the flange, and is secured so that the blades work in facial contact with the opposite blades, A, C, by means of bolts and the collar. When

the pawls are thrown out by the stop dog, the lever holds them out, so that the shears is still, with its mouth open to receive iron, until it is purposely started. This may be done by either the hand or foot of the operator. This is a point of great value to prevent accidents in cutting rails and other heavy iron, as it allows any desired time to get the bar in place, and (when started) cuts it off as quickly as those shears do that keep the jaw always in motion.

Scientific American.

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VOLUME XXXII, No 20. [NEW SERIES.] Thirtieth Year.

NEW YORK, SATURDAY, MAY 15, 1875.

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THE GENESIS OF INVENTORS.

In the symbolic representation of the ages, the characteristic human type of one period is the hunter; of another, the shepherd; of another, the farmer. At one stage of the world's development, the soldier is the prominent man, at another the priest. Now the leading man is the builder; now the adventurous sailor; again the studious philosopher, the far-seeing patriot, the irrepressible reformer, is the commanding spirit of his time.

Of the nineteenth century, the typical man is the inventor. He is at once the leading factor and the peculiar product of modern civilization. He it is that has introduced the elements which chiefly distinguish the life of to-day from that of any and every other period. The hunter, the farmer, the soldier, the sailor, the priest, the philosopher, the statesman, the artist—each fulfils his function; but in no way do they surpass the achievements of other ages, in no way do they help to make our life different in kind or different in character from the lives of our ancestors. The work of the inventor does.

Subtract from the means and methods of our daily life all those elements which are or have been patented, or are the products of patented applications and appliances, and how much—how everything, in fact—that gives distinction to our age will be taken away! Pull out from our houses all the parts save those not now or ever patented, all those that have been formed or put together by patented means, and what a wreck would be left! Take from our tables all the articles, food, and furniture, in whose production and carriage patented inventions have been essential, and how meager our diet would be! Strip from our bodies every article of clothing save those in whose preparation patented inventions have not been employed, and how scant would be our attire! Deprive the wealthy of all the luxuries which invention has brought within their reach, the poor of the comforts and conveniences which the inventor has provided or made possible, and how much of use and enjoyment would go out from their lives!

Just now we are commemorating the brave deeds, the unconscious heroism and wisdom of the founders of our Republic. In no respect can it be said: "They builded better than they knew" than in the provision they made for the encouragement of invention and protection of inventors, then, like themselves, a slender and struggling band of pioneers

on the border of an unbroken continent, a new and unexplored field of effort for the amelioration of human existence. It was not a matter of climate or race, it could not be the conditions incidental to the conquest of a new country, that made the Yankee an inventor above all other men. The same race had undergone similar experience before, perhaps a score of times, yet it did not develop inventors except sporadically. It was not necessity, the reputed mother of inventions, that started our fathers on the course which has wrought a revolution, a multitude of revolutions, in the productive arts. The original need of labor-saving devices in America was no greater than had prevailed the world over since human life began; always and everywhere humanity has stood in want of the beneficent products of the inventor's art, and everywhere it has stood ready to turn such products to good account.

Why then were not more inventions made? Simply because the true parents of invention—encouragement of inventors and protection to their productions were lacking. Those provided, their legitimate issue followed, genius for invention was developed, and its progeny increased in geometrical progression. Every new contrivance gave birth to many, inventive competition set in, and ultimately improvement became watchword in the every department of productive labor.

It is true, the student of pure science comes in for a share, a large share, of credit for making modern life what it is. Very largely he has led the van of discovery and made invention possible. But it must be remembered that it is their practical application that gives material value to such discoveries; and that where such applications are not directly favored, the progress of pure science contributes little to the advancement of human well being. In Germany and in England, the progress of scientific discovery is very rapid, yet invention lags. In this country invention leads, and frequently we take from them the barren scientific fact and return an application which gives it the highest value. It cannot be because the Germans have little inventive genius or practical skill, that they invent so seldom. They turn inventors quickly enough when they come here; an examination of the latest weekly index of inventors, containing some 250 names, shows that fully twenty per cent of those are unmistakably German. That a large percentage of our inventors are of British birth is too well known to call for investigation.

The secret of the superior inventiveness of the Americanized European lies in the fact that here his efforts are encouraged, there systematically repressed. Here we know the inventor's value, and appreciate him accordingly. We know that a fertile soil gives us far less advantage in the markets of the world than the time-saving and labor-saving implements which enable us to win our agricultural products easily and quickly—implements which we owe to our inventors. We know that our commercial superiority and the immense development of our manufactures rest very largely upon the genius and labors of inventors. But a little while ago England led the world in these departments of human activity. To-day her foreign and coastwise commerce falls below ours by an aggregate of over ten million tons annually; while our manufacturing establishments, notwithstanding high priced labor and the predominance of machinery, give employment to nearly a million more operatives than those of Great Britain. How many of our six and half million mechanics could pursue their labors in default of patented inventions? How much of the five thousand million dollars worth of manufactured products, which they turn out a year, would be possible without the inventor's aid? We know our indebtedness to inventors, we welcome them as public benefactors, as prime factors in our industrial system; we protect them in the development and application of their ideas, and reap our reward.

In Europe the contrary custom prevails. In Switzerland and Holland, the inventor is refused any property right in his invention whatever; in the other States, the right is granted as a favor and weighted down with costs and conditions. The inventor is treated as an invader of vested rights, an enemy to trade, a disturber of the peace of the community. The good he may do to the multitude is less considered than the inconvenience he may occasion a few manufacturers by compelling them to improve their wares or cheapen their prices. Patents are regarded not as mainsprings of mechanical progress, but as "fetters" imposed upon industry, as "dragnets" spread to entangle manufacturers and curtail the area of their operations. The rich manufacturer, satisfied with his plant and his profits, calls the poor inventor a "nuisance" or "gambler," who, "instead of contenting himself, like other men, to work and accumulate money by industry, is always scheming, and dreaming, and wasting his time and his money." If successful he becomes sometimes worse than a nuisance. The Lord Chancellor of England, expressing the feeling of the dominant classes of Europe as well as of Great Britain, calls him by implication a black mailer, a sort of mechanical pirate, who robs the manufacturer when he can, and hampers him when he cannot rob; and the leading journals, like the *Times*, rejoice at every prospect of reducing the number of patents and patentees as a relief to productive industry. Under such condition it is no wonder that inventors as a class do not thrive, or that they bring their inventive talents where they are appreciated.

DEATH IN THE SALT CELLAR.

We are not of a morbid turn of mind; as a general rule, we believe that there is nothing to be gained by constant meditation on the uncertainties of human existence; but occasionally something occurs which reveals death lurking in some unthought-of ambush, which presents the idea of mortality in a form which fairly startles one into somber reflection.

If a boiler blows up and kills its attendants, or a sailor is drowned, or a miner suffocated, the circumstance, though we deplore it for the time, leaves no impression on the mind, for it is tacitly expected; but when an hotel full of people, as at a prominent watering place last summer, began to die off like sheep, killed by the water which was necessary to their existence, or the pedestrians in a public street are suddenly hurled to the ground by an explosion of presumably harmless objects, or a bit of color in wall paper or dress carries disease or death, then we are forced into the disagreeable belief that our lives are our own only in a very limited sense.

We have been led, perforce almost, into this train of thought, by the realization of how closely the community has escaped a calamity which might have carried mourning and death into hundreds of homes. The Niagara, a large sailing vessel of the Anchor line, recently reached this port from Liverpool, after a stormy passage of thirty-three days. The cargo of the ship consisted of 1,950 bags of salt of the finest quality, such as is sold for table use. This filled the hold, and the 'tween decks space was devoted to chemicals and general merchandise, the former including about a hundred kegs of arsenic. During the bad weather, the cargo shifted, the arsenic kegs broke adrift, and, pounding against the ship's side, speedily became sufficiently injured to allow of the leakage of their contents. Meanwhile the seams of the vessel, opening, admitted water, and this, mingled with the arsenic, poured down into the salt.

On the arrival of the ship in New York, the chemicals, etc., were taken out in damaged condition, and then the salt bags were removed and delivered to the consignees, who in course of trade lost no time in disposing of the salt, or rather of a portion of it. At this late hour, the thought occurred to the captain of the vessel that the arsenic solution might have poisoned the salt; and acting thereon, he at once telegraphed far and wide to stop its sale and consumption. Professor Doremus was sent for to analyze chemically the material; and from his report, based on the examination of a large number of samples, it appears that the arsenic was present in such considerable quantities as to render the salt utterly unfit for use for any kind of food.

It is stated that the warning has been given in sufficient time to prevent the sale of any of the poisoned substance, the telegrams reaching the parties before the salt itself. But the contemplation of what might have been the result, were such not the case, is enough to cause even the most indifferent to shudder. The salt is said to be still of use for manufacturing purposes, and hence will not prove a total loss. The question of value, insurance, etc., is the gist of a triangular fight between the custom house people, the insurance companies, and the owners; and here we suppose the matter will end. It seems to us, however, that it should not be allowed to drop here. The fact that the lives of perhaps hundreds hung on the memory of one man, and that it was nothing more than mere luck or chance which caused that individual to bethink himself in time, is entirely too serious to be passed lightly by.

The public would like to know who is responsible for such criminal stupidity as the stowage of a terrible poison in a locality where, even by the merest limit of possibility, it could get mixed with a staple article of food; also whether it is customary to pack arsenic in vessels capable of smashing by rolling about the decks. There are plenty of laws regulating the sale of poisons; it might be well, if such are not already there, to embellish the statute books with laws governing their transportation.

THE AGRICULTURAL DISPLAY AT THE CENTENNIAL.

A circular signed by the Chief of the Bureau of Agriculture of the Centennial Exposition, Mr. Burnet Landreth, has recently been issued, directing public attention to this very important portion of the national exhibit, and requesting, from agriculturists generally, aid to ensure its completeness. As the time in which the labors of the Bureau must be perfected is now less than a year, we need hardly point out that hearty practical cooperation is what is wanted from the public, and not mere approval of its ends and purposes. As we have already strongly urged, the period for discussion regarding the Centennial has gone by. The project is to all intents well matured, and is being carried into execution as fast as circumstances will admit. The way to accelerate its progress, therefore, is for each individual to make up his mind as to the part he proposes to take, and to set about preparations at once; or if he is not interested in directly participating, but yet is sufficiently patriotic to desire lending to the show his best aid and comfort, now is the time for him to consider how many ten dollar bills he can afford to withdraw from his business or income to exchange for shares of stock. The investment is said to be a safe one, and the managers of the Exposition believe that a handsome dividend will be returned. Regarding preparation of exhibits, it may be well for farmers to remember that, if they propose displaying specimens of crops, such must necessarily be of the present year's harvest, and sown during the present spring, so that the dressing of the soil, selection of seeds, and other especial cares must be attended to now. Live stock intended for exhibition will also require early attention, although this class of the display will not be exhibited until the months of September and October of next year. The Bureau publishes the following information regarding the time allotted to the various varieties of animals, etc. Horses, mules, and asses will be exhibited, as one group, from September 1st to 15th; horned cattle, from September 20th to October 5th; sheep, swine and goats, one group, from October 10th to 25th. All animals entered, except trotting stock and fat cattle, must be of pure blood and, besides, highly meritorious in condition, etc. Only

the best of each kind is wanted. Exhibitors must furnish attendants, and feed their own stock, for which ample accommodation and good forage at cost price will be provided. Animals will be inspected by a competent veterinary surgeon before admission, and those which become sick subsequently to entry will be isolated and carefully treated. Applications for space must be made at once (address the Chief of the Bureau of Agriculture, Philadelphia), in order to enable the officials to form a proper estimate of space, etc., required. We would remind farmers generally that the liveliest interest is taken abroad in the subject of stock-raising in this country, as witness the large attendance of foreign buyers at the great sale at which the famous \$60,000 cow was disposed of, a year or so ago, and that without doubt the representatives of the Earl of Leicester, Colonel Towneley, the Earl of Radnor, the Dukes of Bedford and Rutland, Mr. Bakewell, and in fact of all the great English sheep and cattle breeders, will be among the most critical visitors and perhaps future purchasers of the animals displayed.

The entries which will represent the labor and skill of our agricultural population, as well as the products peculiar to our soil, are so numerous and varied that it would be impossible even to summarize them here. Cotton, corn, and tobacco, the marvelous fruit and vegetable productions of the Pacific coast, the yield of the maple trees of New England and of the orange groves of Florida, will be prominent in the general exhibit, and the lumber from our Northern States will be placed side by side with that from the vast Scandinavian forests. The necessity of a very complete display of the timber of all districts of the country may be especially urged. Samples of trees of all kinds are asked for by the Commission, and it is suggested that the bark of one or more of the giant trees of California (*Washingtonia gigantea*) be taken off the trunk in segments and sections, to be placed on arrival on a skeleton frame of the same dimensions as the original. The Agricultural Hall, having an extreme elevation of seventy-five feet, will afford ample room for at least a partial exhibit of one of these monsters of primeval forests. Thus also with other trees of the Pacific coast, hardly secondary to it, as *Abies Douglasii* and *nothofagus*, *Libocedrus decurrens*, *Pinus Lambertiana*, the white pine and hemlock of the North, the yellow pines in their several species, the live oak, the cypress (*Taxodium distichum*) of the South, and a long list from every section of our broad territory.

In addition to specimens of trunks of trees should be exhibited timber and lumber in all forms; as samples of masts and spars, large and small; knees and square timber, as prepared for naval purposes; planks and boards exhibiting unusual breadth and character of cell and fiber: in brief, every description, quality, and form of wood used in construction and decoration.

We are gratified to note an increasing interest on the part of all classes of the public in the Centennial everywhere. Several prominent business houses have given generous subscriptions. A popular movement in New York toward the furtherance of the enterprise is about to be made. It seems to us that some grand representative structure from the metropolis, typifying its growth within a century from a mere village to one of the greatest cities in the world, would be appropriate and in harmony with the general surroundings, and might at the same time be a means of arousing a greater local interest. Boston is busily engaged upon something of the sort in the shape of a tower, which will be built wholly of iron and will rise to a height of 200 feet, or 540 feet above the river level. It is to be used as an observatory, and elevators will transport visitors to the summit. The contracts for the iron work are already awarded, and the edifice is to be completed on July 4 of the present year.

THE MANAGEMENT OF BOILERS AND ENGINES.

Extensive as is the literature connected with the steam engine, there is very little in print in relation to the practical management of steam machinery. It is not difficult to discover the reason for this omission. The practical details are so varied, for the different cases that may arise, that it is almost impossible to classify them. It is impossible so to foresee that the remedy for any emergency which arises can be prescribed in advance; and it is not desirable that the engineer should trust implicitly to a set of formal rules, which will leave him helpless to provide for a case which is not covered by the directions. At the same time, there are a number of general principles, which every engineer learns by experience, and their publication may be of use to those whose experience has yet to be acquired. Many steam users, recognizing the importance of having their machinery carefully managed, are in the habit of sending engineers and firemen to be examined in regard to their qualifications before engaging them. We give below an abstract of an examination recently conducted by a well known expert. The engineer who was examined was unusually well qualified for his duties, and a record of his replies may therefore prove very useful. Omitting the questions, the following summary gives a fair idea of the scope and character of the examination.

THE ENGINE AND BOILER.

"I have not examined the engine and boiler very carefully, but there is a horizontal engine, with plain slide valve, diameter of cylinder, 12 inches, length of stroke, 26 inches. There is a horizontal tubular boiler, set in brick, diameter, 4 feet, length, 11½ feet, steam dome, 24 inches in diameter and 15 inches high, number of tubes, 65, each three inches in diameter. I have not examined the connections of the boiler, but I can tell you what they should be, if the boiler is properly set. There should be a feed pipe, 1 inch in diameter, with globe valve and a check valve, the former being nearest the

boiler, so that the check valve can be examined at any time, if necessary. There should be a blow-off pipe, distinct from the feed pipe, with a plug cock, outside of the brick work. This pipe may be tapped into the boiler if attached to one of the heads; but if secured to the shell, it would be better to use a flange. There should be a safety valve, 2 inches in diameter, attached to the top of the steam dome, and a 2 inch steam pipe leading from this connection to the engine, with a stop valve close to the boiler. There should be 8 gage cocks, the bottom one about 8 inches from the top row of tubes, the distances between them being from 3½ to 4 inches. There should be a water gage, attached direct, if possible; but if this is not possible, the connecting pipes should be arranged so as not to be in contact with the flame or hot gases. There should be a steam gage, connected with the upper part of the boiler, and arranged with a siphon and drip cock. The grate bars should have a side play between each other, when cold, of from ⅛ to ¼ of an inch, and an end play of between ¼ and ½ of an inch. The heating surface of a boiler is all the surface exposed to the flames and the hot gases, including that part of the shell in the furnace, the ends of the boiler, and the interior surface of the tubes.

THE ENGINEER'S DUTIES.

"The ordinary daily duties of an engineer are as follows: On coming in the morning, he should first ascertain the amount of water in the boiler; and if that is all right, proceed to raise steam, either cleaning and spreading the fire, if it has been banked, or making it up, if it has been hauled. A fire is kindled in a boiler in essentially the same manner as in a stove, wood and shavings first being ignited, and then covered with coal. In starting the fire, it is a good plan to cover the back of the grate with coal, to prevent the passage of cold air through the tubes. In getting up steam, the safety valve should be raised a little, to permit the escape of air from the boiler. Having got the fire under way, the engineer should wipe off the engine, fill the oil cups, and make any adjustments that may be necessary, such as tightening keys, and screwing up joints or glands of stuffing boxes, and should see that the cylinder cocks are open. When steam is raised, he should open the stop valve, and start the engine; after which, if a part of his duty is to attend to the shafting, he should examine and oil it. Then he should get out the ashes, provide a supply of coal, and screen it if necessary, and proceed to make everything tidy around the engine and boiler. Throughout the day, he should keep a watchful eye on the fire, the water, the steam, and the engine. In managing the fire, care should be taken to have the furnace door open as little as possible; and if steam is formed too rapidly, the fire should be regulated by closing the damper and ash pit doors. In regulating the height of the water, it is a good plan to keep a steady feed, and maintain the height constant. If it is found that the water is falling, the engineer should discover whether it is caused by a leak, or by the refusal of the pump to work. He can tell whether the pump is working by the sound of the check valve falling after each stroke, or by feeling the feed pipe or check valve. A pump will not feed when the temperature of the water is very high, unless it is specially adapted for pumping hot water; and if it refuses to work from this cause, the temperature of the water should be reduced. A pump will not deliver water if the proper valves are not opened, if its passages are choked, or if its packing is defective. It would be necessary to examine the pump at once, and endeavor to discover and remedy the difficulty. If the water falls in the boiler on account of a leak, it can sometimes be temporarily repaired with a plug, or the pump can be run faster, so as to keep up the water until stopping time. If this is not possible, the fire should be hauled, and the engine allowed to run as long as there is sufficient steam pressure. In case the engineer finds that the pump is not feeding, and he has a fair supply of water in the boiler, he should at once examine the pump, and endeavor to remedy the trouble without stopping the engine. If he does not succeed, however, before the water falls below the level of the lowest gage cock, he should haul the fire, and let the engine run as long as the steam pressure is sufficient. If he has been called away from the boiler, and on his return finds that the water is below the level of the lower gage cock, he should immediately ascertain the steam pressure, and if it is rising rapidly he should haul the fire at once. If the steam pressure is about the same as usual, he should examine the pump; and if it is not delivering water, he should haul the fire. If the pump is feeding, he may run it faster, watching the steam gage carefully. If the pressure does not fall, he should stop the pump, and haul the fire. In any case the engine should not be stopped until the steam pressure is considerably reduced. The engineer should be very particular, on finding the water low, to examine the steam gage at once; and if the pressure is unusually high, he should haul the fire without delay.

"A boiler foams or primes, either because it has insufficient steam room, or on account of dirt or grease in the boiler or the feed water. The trouble is often experienced with new boilers, and disappears when they become clean. Priming is dangerous, if much water is carried over with the steam, as it is difficult to maintain the water level constant, and the engine is liable to be broken by the water in the cylinders. If the trouble is caused by insufficient steam room, it can sometimes be partially overcome by increasing the steam pressure, and throttling it down to the ordinary working pressure in the cylinder, but the only effectual way is to provide more steam room. If the priming is due to dirt or grease in the boiler, the engineer should blow off frequently, and clean the boiler every few days. In blowing off, it is well to raise the water level in the boiler by

putting on a strong feed, and then blow down below the level that is ordinarily maintained. It is very often the case that the water level is higher, when the engine is running, than it is when none of the steam is being used. The engineer should ascertain how much higher the water rises in such a case, so as to have a proper quantity of water when the engine is stopped.

CLEANING THE BOILER.

"The flues or tubes of a boiler should be cleaned about once a week, with a brush or scraper. In case incrustation has formed in them, they can be cleaned by a jet of steam from a rubber hose. A boiler should be blown down and cleaned, under ordinary circumstances, about once a month. The fire should first be hauled; and then, if possible, it is best to let the boiler stand until the water becomes tolerably cool, say for 12 hours, after which the water may be allowed to run out. Then remove the man and handhole plates, enter the boiler, and clean it with scrapers and brushes in every part that can be reached. It should then be washed out with cold water from a hose, and this washing with a hose is the only means of cleaning those parts of a boiler that cannot be reached by hand. There are many boilers into which a man cannot enter, and of course these can only be washed out. When the fire is hauled, all leaks in the boiler should be repaired. Leaky parts that are exposed to the fire must have patches riveted on; in other places patches secured with bolts can be used, each patch having a lip around it, and the joint being made with a putty composed of red and white lead. Leaky rivets or seams can sometimes be made tight by caulking. Small leaks around the ends of tubes can often be stopped in the same way, but as a general thing a leaky tube must either be replaced or plugged. To plug a tube, drive a white pine plug tightly into each end, and cut it off even with the tube heads, then pass a bolt through the tube, with cup washers on each end, and screw it up tightly, putting putty under the washers.

WATER AND STEAM GAGES.

"When a boiler is in use, the gage cocks should frequently be tried to see that they are not choked up, and the glass gage should often be blown out. After ascertaining the proper place for the weight on the lever of the safety valve, a stick should be secured to the lever with wire, so that the ball cannot be moved out any farther. A cord should be secured to the safety valve lever, within easy reach of the engineer, so that the valve can be opened by hand if it sticks, and the safety valve should be tried at least once every day to ascertain whether or not it is in working order.

"A steam gage should be tested at least once a year, and the engineer should frequently try its accuracy by allowing the steam to raise the safety valve, and noting the pressure shown by the gage. The hand of a steam gage sometimes sticks, and the engineer should tap the face of the gage lightly several times a day, to assure himself that it is in working order. He may also shut off the steam from the gage pipe, and open the drip cock, noting whether the hand goes back promptly to 0, and returns to the former reading when steam is again turned on.

"In testing a boiler, warm water should be used, and a better test, when this is possible, is to enter the boiler and make a thorough internal examination.

"In leaving a boiler for the night, the fire may either be hauled or banked. If it is to be banked, it should first be cleaned, and then pushed back and covered with coal, the boiler being left with the furnace door open, and the damper closed.

"The principal derangements of engines are hot bearings, loose keys, and leaky joints. If a bearing heats continually, when properly adjusted and well lubricated, it is too small. Sometimes bearings heat, on account of dirt or grit, because they are set up too tightly, or are out of line. A hot bearing can often be cooled without stopping the engine, by mixing sulphur or blacklead with the oil, or by turning on a stream of water from a hose. If a joint blows out, it can sometimes be wedged, so that the engine can be run until stopping time. An engineer should exercise all his ingenuity to overcome a difficulty without stopping the engine, except in cases where it would be dangerous to continue to run. If keys or bolts become loose, it will generally be indicated by a thump in the engine. To prevent the freezing of pipes and connections in exposed situations, they should either be thoroughly drained, or the water should be kept circulating in them."

Our readers will scarcely need to be told that a man who could pass such an examination as this understands his business pretty well, and we think that the foregoing remarks will be read with interest and pleasure by all who manage engines and boilers.

Photography of the Electric Spark.

Mr. Leo Daft, photographer of Troy, N. Y., has sent us several photo stereotypes, recently made, of electric discharges between the terminals of the Holtz static electrical machines. In some of the examples, the picture shows the electrical flow divided into ten streams, which have the appearance of ten fine, white, zigzag wires, sharply defined and arranged in the form of an elliptical framework. It is probable that the metals used in the terminals had something to do in giving the remarkable actinic power to the sparks which these photo impressions indicate. Mr. Daft intends to continue his photo-electrical experiments, which are certainly very interesting.

Live fish (pickerel or trout) will keep a cistern free from worms and bugs.

IMPROVED SURFACE PLANER.

It is claimed this machine will plane or surface hard or soft wood from $\frac{1}{4}$ to 6 inches thick and 24 inches wide, and in any quantity from 10,000 to 20,000 feet per day, and will plane smoother than the average large sized planers. It is very strong, and is capable of doing its work in the most thorough manner, being built entirely of iron and steel, heavy and substantial in all its parts, the proportions being such as to insure the greatest durability and strength.

The main frame or stand is a solid and strong casting in one piece, forming a rigid and solid support for the material to be planed, thereby insuring smooth planed work. The cutter cylinder has long steel journals perfectly fitted by scraping into self-oiling bearings lined with the best anti-friction metal, made for the purpose. The journal boxes form the upper part of strong adjustable slides with long gibbed bearings, and the cylinder can be raised or lowered, while in operation or not, by means of a hand wheel placed in a convenient position for the operator. Any wear of the slides can be taken up and nicely adjusted by the gibs. A graduated scale attached to the slides shows at a glance the distance between the table and cutter cylinder. The upper feed rolls are held down by cast steel spiral springs, which are very sensitive to the unevenness of the material, and act quickly and strongly.

The two driven feed rolls are in close proximity to the cutter cylinder; the distance between them is only $\frac{7}{8}$ of an inch, so that short and long stuff can be planed without clipping the ends. An adjustable roller scraper is attached to the back feed roller to keep it free from gummy matter. The feed arrangement is extraordinarily strong, and powerful; the gearing is of a small diameter, and is not at all liable to break. The feed can be instantly started or stopped, and the material returned if desired.

The machine has four idler rolls and two driven feed rolls, all of wrought iron, making in all six rolls which can be adjusted to take up the wear. The cylinder bonnet can be quickly swung back for the purpose of sharpening the knives, and the gearing bonnet can also be raised for oiling the parts.

For further particulars, address Bentel, Margedant & Co., Hamilton, O.

Imitating Enamel on Iron.

F. W. Oliver's process consists in producing on iron various designs of different colors, and imitating vitreous enamel in the following manner: A crystalline appearance is given to tinned iron by means of a mixture of water and sulphuric and nitric acids, applied thereon, and afterwards washed off. An impression of a design is made on suitable transfer paper, on which coatings of solid white and silver bronze dust and colors are applied. The plate, prepared as above, is coated with a mixture of turpentine and copal varnish: it is then heated, and the design transferred thereon in the usual way, and the plate is baked and polished.

APPARATUS FOR REMOVING CONDENSED STEAM FROM PIPES.

We extract from the *Moniteur Industriel Belge*, the annexed engraving of a simple device for removing water produced by the condensation of steam in pipes. The action of the mechanism is entirely automatic. A is the entrance pipe, and B the exit pipe of the water; C is a float balanced by the counter weight, D, and resting on the surface of water which accumulates in the lower part of the vessel. As the float is raised by the addition of water, a pinion on the shaft, on which its rod turns, engaging in a rack, elevates a slide valve, E, and so opens the escape orifice. The water then flows out until the float falls low enough to shut the valve once more. A device of this kind, attached to the steam heating apparatus of a building, would doubtless prevent that disagreeable clacking and hammering due to the water forming in the pipes, and the consequent injury to the latter owing to repeated strains.

Supplying Caged Birds with Green Food.

"Among other advantages," says a correspondent in *Science Gossip*, "derivable from the regular supply of such plants as chickweed, shepherd's purse, and groundsel to caged birds, especially finches, I find that these almost always increase the appetite, leading them to eat more seeds, in cases when they appeared falling off a little from their ordinary food. In early spring the leaves of the plantain are much relished by bullfinches and canaries, and they seem to have a wholesome effect. I should like to hear the opinions of bird fanciers regarding the statement, often repeated in books, that birds derive no benefit, but rather the reverse, from green food given in frosty weather. I have not found any evil result, on a small scale, provided the food is not given too damp."

Improved Method of Laying Underground Telegraph Lines.

Mr. A. Holtzman, of Amsterdam, Holland, is the author of a method which is alleged, after two years of trial, to give

the most satisfactory results. But as there are no patent laws in his native country, he is obliged to seek for compensation and encouragement to extend his invention, to the more liberal institutions of foreign countries. The Holtzman plan consists substantially in providing a cast iron trough, which is filled with a peculiar bituminous insulating compound, which he terms *brai liquide*. The gutter rests in the bottom of a ditch in the earth. The compound is put in while warm and semi-liquid. The telegraph wires, insulated with gutta percha, are then submerged, separately, in the compound in the trough; the latter is then closed by a cover and the ditch filled with earth. The compound soon cools

metal has formed the subject of a recent investigation by M. Heinrich Streintz, described by him to the Vienna Academy. The resistance which wires oppose to torsion within the limits of elasticity is less the oftener such torsions are produced, or (as the property is denoted) the wire "accommodates" itself to torsions. The same decrease of resistance is observed where the wire has been annealed. Now, a newly drawn wire is denser, it is known, than an annealed one; the molecules in the former are nearer each other, and are in a state of reciprocal tension, and so they must present a greater resistance to displacement.

When a newly drawn wire is heated, the reciprocal tension is still further increased: as we find indicated by the fact that the deadening becomes greater, and, at the same time, in consequence of this tension, an actual pushing asunder of the molecules takes place. If the wire is then allowed slowly to cool, the molecules go together again, but no longer in the way corresponding to their natural state of equilibrium—they do not now go into their earlier condition of tension; and we obtain a wire, consequently, in which the internal friction is less. Now, as through frequent turnings, within the limits of elasticity, the wire becomes softer for such turnings, the same occurs in other changes of form.

It is known that steel pens become softer through use, which involves continual slight changes of form within the limits of elasticity. A similar thing occurs in the seats of iron chairs, formed with tips of wrought iron or steel. They lose their hardness through use, and are ultimately bent.

Accommodation plays an important part in musical instruments. It is a well known fact that trumpets, before they can be employed in public performances, must first be blown in or used for a considerable time, in order to develop their full tone action, and make them capable of being easily blown. In fact, the deadening has first to be lessened for the tone vibrations (or the resistance of the metal to these), and this is effected by putting the metal frequently in vibration. A trumpet may also be blown out of tune. If, when quite new, it comes into the hands of an inexperienced performer, who often blows certain false notes, the trumpet is blown out of tune. This is to say, the deadening decreases for these particular tones, so that the trumpet is more easily thrown into these vibrations than into others, which are not so often excited; and it becomes, therefore, very difficult for even a practised performer to avoid these false tones. It would in this case be of no use to diminish the dead-

ening of the trumpet metal by a temporary heating, for this process would affect all the tones similarly; only correct blowing will bring about the desired result.

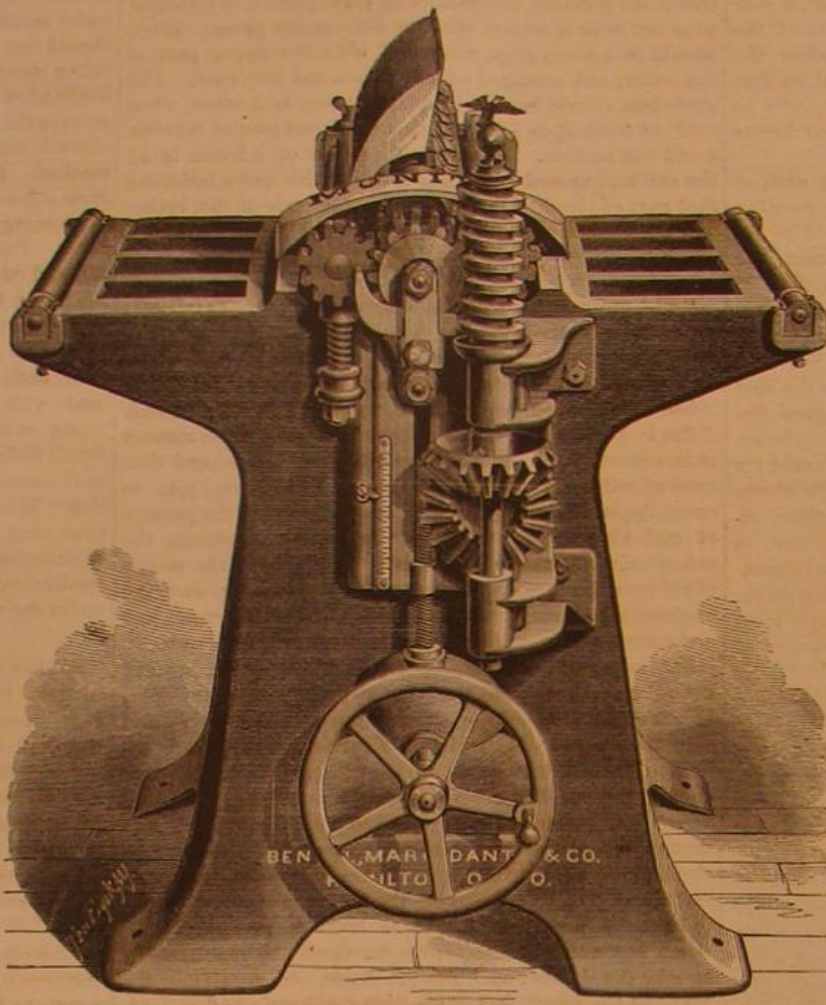
A similar experience is had with stringed instruments. In these, it is not the strings that require long playing, for their resistance to the vibratory motion is (owing to the smallness of mass to be moved) unimportant; but the resonance ceases. However excellent the construction of the latter, a long continuance of good playing is indispensable for them.

This is accounted for by the fact that the good player awakens a stronger tone, and so vibrations of greater amplitude; hence, also, for these, the deadening is diminished. Further, he excites only a certain kind of overtones, which determine the clang color, and for these overtones the deadening is diminished. Through long rest without use, the advantages of this playing-out are again lost, as the accommodation also partly disappears through rest. That pianos do not also grow better after long use is due to the fact that the mechanism of the piano wears out.

The circumstance that, with increasing temperature, the deadening grows so very quickly may perhaps serve somewhat to explain the process of hardening of steel. The soft steel is heated, and thereby the molecules are brought into a state of greater internal friction. If now, the hot steel is quickly cooled, the molecules have not time to part with this condition of greater internal friction; it still remains, in part, in the cold state, and we have then a hard steel. The steel, it is known, is harder the quicker the cooling occurs. The resistance of the molecules of hard steel to magnetization, and the greater magnetic residuum, witness also to the greater internal friction of its molecules.

Dry Rot in Lemon Trees.

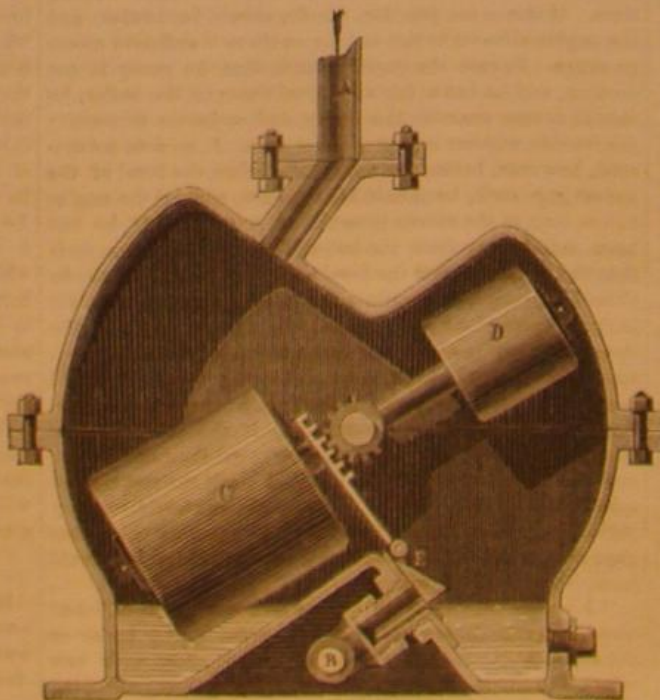
A malady has attacked the lemon plant, the origin of which is believed to be the forced cultivation of the fruit. The lemon plant is very hardy, and infinitely easier to cultivate than the orange, and this fact has probably induced a certain amount of carelessness in its treatment, from which growers are now suffering. The tree was originally a native of the dry and hot soil of Persia, whence it has been transferred to various other countries, where, under different circumstances of soil and climate, it has been made largely to increase its yield of fruit. The disease which has now made its appearance is called *la sécheresse*, or dry rot, and seizes the extremities of the plant, sometimes the roots, sometimes the branches, whence it gradually spreads through the whole tree, drying up its sap in its course.—*Nature*



BENTEL & CO'S SURFACE PLANER.

Metal Deadening.

When a wire, by which a weight is suspended, is made to swing about by torsion, the amplitude of swing, it is known, ever diminishes; the successive amplitudes form, according to Gauss and Weber's observations, a converging geometrical



APPARATUS FOR REMOVING CONDENSED STEAM.

series, and the natural logarithm of the exponent of this series is called the *logarithmic decrement* of the arc of oscillation. We understand by the deadening of the swings, or oscillations, the phenomenon of their ever growing less. The cause of this deadening is partly in the resistance which the air opposes to the motion, but partly in the wire itself, the detortion of which also presents resistance to the motion.

This phenomenon of internal deadening (*dämpfung*) of the

THE NEW YORK RIVER FRONT IMPROVEMENTS.

We publish herewith a view of a series of the arches which are to form the extensive improvements now being carried out on the North River front of this city. There can be but one opinion as to the efficiency and solidity of the construction, the design for which is the work of Mr. J. Newton, assistant engineer, and possesses several interesting and original features. The work which our illustrations (selected from *Engineering*) depict is now in progress on the west side of the Battery, where the river bottom is a hard, quartzose rock. Before the dredging was done, the rock was covered with a deposit of river sediment, in some places upwards of 12 feet in thickness, and varying in consistence from a thin silt to a tough, plastic, black mud. This was cleared away by the dredging machinery already described in our pages. The surface of the rock is jagged and

and it was lined with a heavy canvas sack to protect the concrete from wash; at the formation level, horizontal guides were secured. The box was then filled with concrete, lowered in buckets which opened at the bottom. When the concrete reached the guides just mentioned, it was leveled off by a heavy iron beam placed on one of its sides, and pushed along the guides from one end to the other; by this means, if the guides are properly placed, the entire foundation is perfectly level. The voussoirs were cut before the foundations were begun, and the top of the pier came at the exact height required above datum.

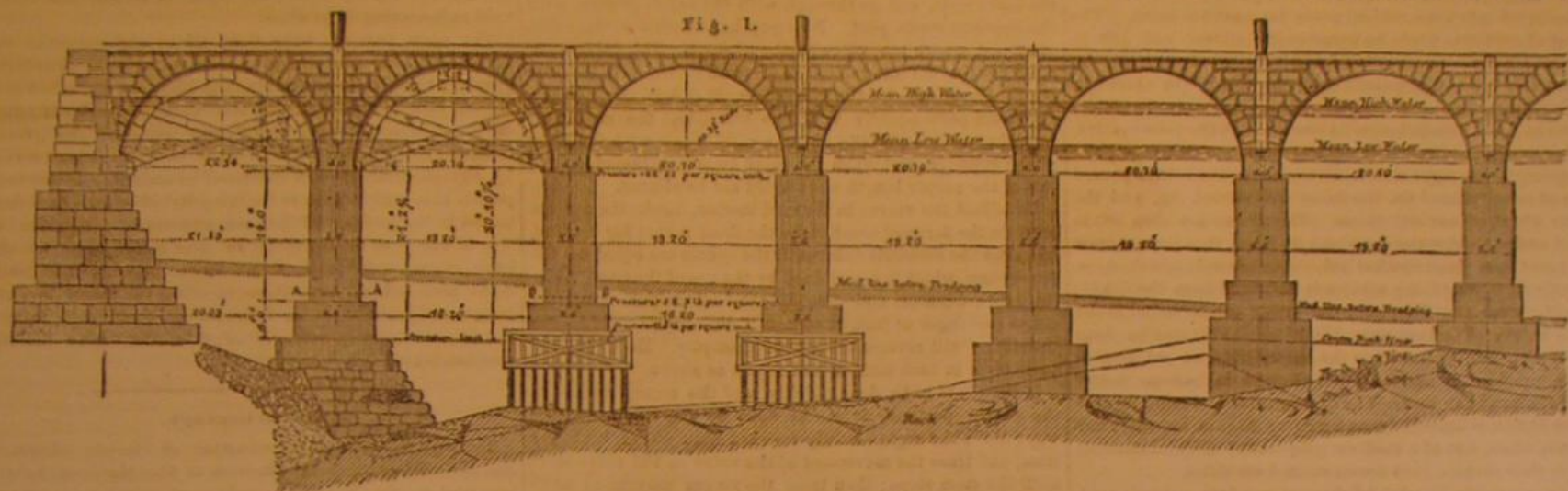
The first foundation, already alluded to, was put in by constructing a box or inclosure under water. A number of wrought iron standards (Fig. 2) were placed in line in the centers of the same number of molds on a level platform; these molds were then rammed full of concrete. The blocks,

the size of the monolith has but little to do with the time required for placing it.

The concrete of which the monoliths are made is composed of the best Portland cement. When the wooden molds are removed, which may be safely done in twenty-four hours after they are filled, they present a smooth and hard surface, and more accurate than it is possible, in practice, to cut the beds and builds of natural stone suitable for hydraulic work. A cube one foot square formed of this concrete, seven days old, did not yield until the pressure brought upon it by a hydraulic press was 80 tons, and then the concrete in the middle of the block was found to be somewhat damp.

A New Dry Photo Process.

I propose, says M. Carey Lea, to make public a process which, I think I may venture to say, possesses a very high



NEW YORK RIVER FRONT IMPROVEMENTS—THE ARCHES.

very irregular, and the depth of water over the site of the pier is from 25 to 45 feet. The dimensions of the pier are 500 feet in length; 80 feet in width; height of roadway above mean high water, 5 feet, and from mean low water, 9.58 feet. The mean rise and fall of the tide in New York harbor, as determined by a long series of observations, is 4.58 feet. The pier is composed of twenty full center arches of 20 feet span; the faces of these arches, exposed on the sides of the pier, down to 3 feet below low water, are of cut granite. The arches are supported by monolithic blocks of concrete, made to exact dimension by ramming the materials in strong wooden molds. These blocks are made with suitable grooves for chair slings: they are transported from the place where they were made, and placed in position in the pier, by the floating derrick previously described. These concrete monoliths are in two series: First, the base; these are 4 feet by 8 feet 6 inches by 13 feet; next, the piers which are placed on these. For the first three or four arches these are 14 feet in height, 5 feet 6 inches thick, and 10 feet in length, eight being required to complete a pier.

When these tall monoliths are in position the work is so near the water line that it is an easy matter to place the centers which rest on them, and then set the granite voussoirs. The centers being set, the facing of granite is laid in cement; between the granite springing stones of the arches, concrete blocks are laid. These are made in molds to the curve of the soffit, and are plainly shown in the engravings; these blocks bring the work above low water. The joints in the granite being watertight, and the sheathing of the centers nearly so, the space thus inclosed between the stone sides of the pier, if not altogether watertight, is protected from the wash of the tidal current; this space is then filled with concrete, well rammed in, and the work by this means is rendered as solid as that formed in the molds.

If desired, however, there is no difficulty in making this space perfectly watertight by caulking the sheathing of the centers, so that the concrete could be rammed in at all stages of the tide.

The foundations at formation level are 84 feet in height by 12 feet in width, and vary in distance from datum according to the irregularity of the rock bottom. In all, except in the first pier from the river wall, they have been constructed by sinking a box the full size of the foundation. This box was weighted and sunk, then, by means of vertical timbers, chains, and screws, adjusted to the required height. This box (see Fig. 2) was roughly fitted on the irregular rock bottom by means of planks sliding in appropriate guides,

thus made, with the standards firmly imbedded in them, were then placed in line on the site of foundation. Planks were then placed between the standards, the top one, which formed the guide, being carefully placed at the required distance below datum. The filling then proceeded as in the others. Several of the foundations for this work were laid in from 25 feet to 30 feet of water, where the tide at certain stages runs with velocity sufficient to make it very difficult for divers to hold on. The water always holds in suspension so much mud as almost to exclude the light, even on a very bright day, at the depth this work was done; so that the whole of it was performed in what was practically total darkness. On one or two occasions, when the sun was high and the atmosphere perfectly clear, a plumb bob, some 8 inches in diameter and painted white, was barely visible.

The use of concrete in monolithic masses, as above described, enables work of this character to be erected in very much less time and cost than would be required with coffer-

interest; in fact, no photographic work in which I have ever been engaged has appeared to me comparable with it.

The method gives, by simply pouring an emulsion over glass, not only a high but, I may say, an intense sensitiveness. Moreover, by virtue of the silver iodide which they contain, these plates need no backing. They develop with great rapidity and need no intensifying, so that the whole operation, from first to last, is reduced to the most absolute simplicity. The advantages in the way of facility of management and the high degree of sensitiveness are such that I should not be surprised to see these dry plates largely supersede the wet process; in fact a beginner will more easily work this dry method than the wet when the emulsion is to be obtained commercially, which it soon will be, as I do not propose to place any restriction upon its manufacture by any one who may choose to prepare it.

COLLODION.

To each ounce of solvent, consisting of alcohol and ether in equal parts, take ordinary crystallized cadmium bromide, 6½ grains; ammonium bromide, 2 grains; ammonium iodide, 1½ grains; cupric chloride, 1½ grains. About eight grains of intense pyroxylin to the ounce, with two drops of *aqua regia*. Sensitize with silver nitrate, using from twenty to twenty-five grains to the ounce. The first-mentioned quantity is excellent for ordinary work; when a very high degree of sensitiveness is desired, the larger quantity may be used.

For the reason that the emulsion is to be dried, some economy may be practised by making a more concentrated emulsion, as follows: ordinary cadmium bromide, 9 grains; ammonium bromide, 2½ grains; ammonium iodide, 2 grains; cupric chloride, 2 grains.

Use about ten grains of intense pyroxylin. The silver nitrate must be increased in the same proportion as the salts, so that twenty-five to thirty grains to each ounce of concentrated collodion will be proper. Three ounces of this collodion will, after treatment, give four ounces of finished emulsion.

The best results are obtained by keeping this emulsion, with occasional shaking, for from twenty-four to thirty-six hours. It is then to be poured out into a flat dish and allowed to set. Particular care is needed in this part of the operation; the preservative must be applied just at the right time—neither too soon nor too long after the pouring out. The emulsion must be occasionally examined and moved about in the dish to promote equal drying. As soon as a skin forms on it, holes must be made through it, and the collodion underneath be made to flow out and over it. If this be ne

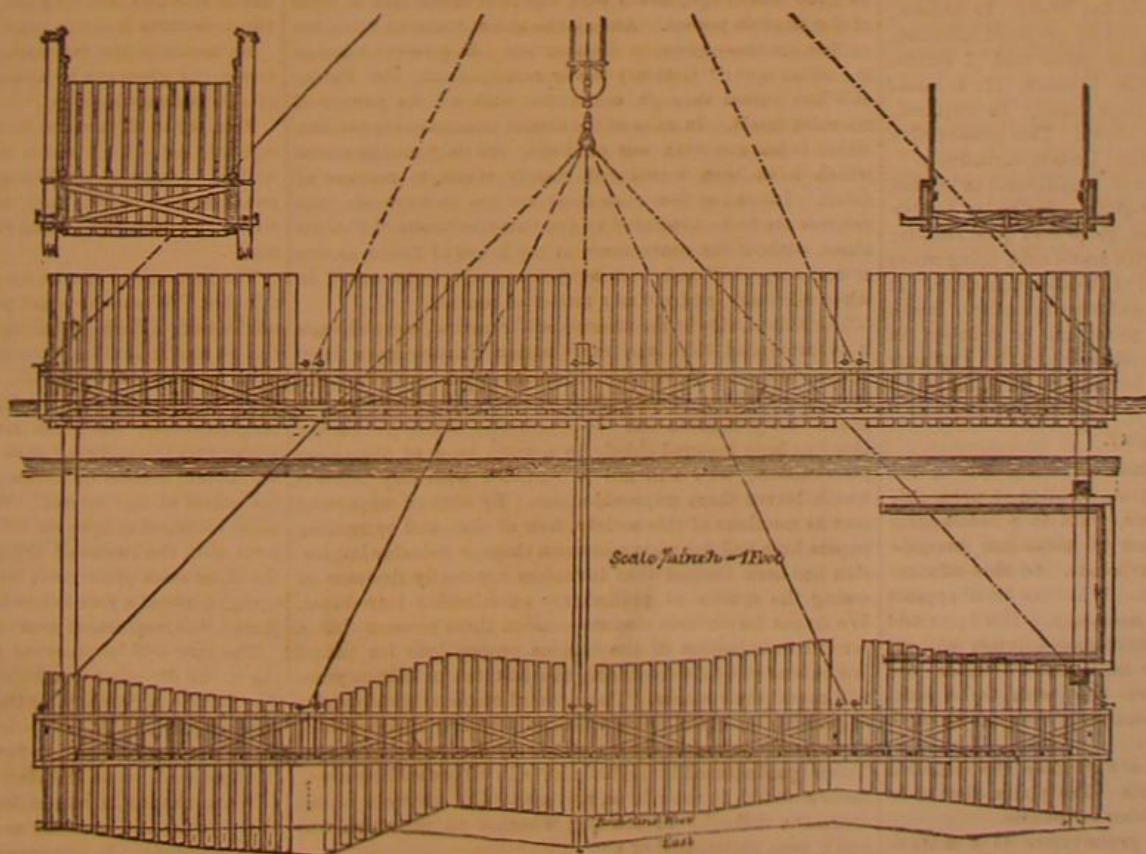


Fig. 2.—CONSTRUCTING THE FOUNDATIONS.

dams and ordinary masonry. The preparation of the bed for the monolith, as is evident from the above description, is in fact the only portion of the work which is at all difficult. Under favorable circumstances, with respect to weather, after the foundation is ready, the arch piers, 80 feet in length, were set in 30 feet of water, ready for the superstructure, in 2½ days. It required scarcely ten minutes for the derrick to lift and place a monolith of some 30 cubic yards, but setting it exactly in place occupied longer. It may be observed that, within the capacity of the derrick,

lected, the surface will become hard and leathery before the emulsion is set underneath. The object is to keep the whole mass as nearly uniform as possible, and, as soon as it is gelatinous, to apply the next treatment. The proper condition can be judged of by touching with the tip of the finger; as soon as nothing comes off upon the finger the emulsion is ready for the preservative.

Any preservative may be used. As to the effects of different preservatives, I will speak presently. If the lesser quantity of silver be used, the preservative may generally be applied in its ordinary condition; but if the larger, then it will be well to add to the preservative one tenth of its bulk of ordinary acetic acid (No. 8 or Beaufoy's).

The preservative is to be poured into the dish, and then immediately the film is to be plowed up with a porcelain, horn, or glass spatula (not a metallic one), and reduced into small pieces; and the whole, preservative and film, is to be transferred into a convenient glass jar—not too small. The flakes of emulsion are to be occasionally stirred and left in contact with the preservative for fifteen minutes from the time when it was first poured over the mass. (In operating upon a large scale, commercially, it will probably be found better to leave a little longer in contact with the preservative, and always to acidify. For working with a few ounces, the foregoing is the right way.) The preservative is then poured off and water poured on, the flakes well stirred up, and the water changed several times. The flakes are then left to stand under clean water for about an hour; then several more changes; then stand another hour; then several more changes. By this time everything soluble is extracted from the flakes; indeed, after the first hour no silver can be found in the wash water. We have now only to dry. This may be done at ordinary temperatures, or the vessel may be set over a stove, provided its bottom be not allowed to become hotter than the hand can bear. The drying must be thorough; the flakes shrink wonderfully, and curl up like tea leaves. They are not white, but of a medium grey color, notwithstanding which they make a pure cream-colored emulsion.

To re-emulsify, the dried flakes are put into a bottle and are covered with one third ether, one third alcohol, and one third plain collodion. They must be well shaken at intervals. The new emulsion is not in good order till after, at least, forty-eight hours, and is better at the end of a week. When it has once been thoroughly mixed with the liquids, and has been shaken at intervals for some days, it seems to lose all disposition to settle, and makes a most excellent emulsion. There is no reason why it should not keep indefinitely. Or it may be preserved in the dry state and emulsified at any time, using from twenty to twenty-five grains of the dry emulsion to each ounce of solvents. Three and a quarter ounces of collodion, formula No. 2, will yield about one hundred grains of dry flakes.

PRESERVATIVES.

The character of the image will depend very much upon the preservative used.

Albumen Preservative.—This gives an exceedingly sensitive and delicate plate, with much less density than most of the other treatments. For this reason I prefer it to the rest, as tending to give detail in both lights and shadows, with great varieties of half tone. My formula is: Water, 12 ounces; thick gum and sugar solution, 1 ounce; prepared albumen, 1 ounce; sixty-grain alcoholic solution gallic acid, 1 ounce; sixty-grain tannin solution (in water), $\frac{1}{2}$ ounce. To be added in the order named. If rather more density be required, double the tannin. I use it as above. This preservative works very cleanly and satisfactorily; I use it exclusively.

Gallic Acid and Coffee.—A mixture of gallic acid and coffee, using about two ounces of sixty-grain solution to twelve ounces of infusion of roasted coffee, gives very good results; it should, however, be acidified with acetic acid, using about half an ounce of Beaufoy's (No. 8) to the above quantity. It gives a blacker image than No. 1, and more intensity. It will probably be useful when the pyroxylins is deficient in intensity. It gives excellent transparencies by exposure under a negative, but too intense for lantern work, for which No. 1 is much better, as well as for negatives.

DEVELOPMENT.

For a 6x8 plate pour four ounces of water into a 7x9 dish, add half a drachm of sixty-grain solution of pyrogallol in alcohol, and put in the plate. Mix in a bottle equal quantities of a fifteen-grain solution of potassium bromide and an eighty-grain ammonium carbonate. Of this mixture pour one fluid drachm into the dish. When the detail appears add another drachm, and later, if necessary, a third; or add half a drachm of the ammonium carbonate solution without bromide. The two first additions must have bromide; the third is best without for a negative—best with for a transparency. Fix in hyposulphite solution of the same strength as used for wet plates.

I should have mentioned that I always keep the collodion for a month—for several if possible. The plates should be edged with a solution of india rubber in benzole.

The principle of applying a preservative to a mass of material at once and then washing it out again could be patented. This is common to the new processes. The plan of applying a silver bath to a mass of partially dried collodion is also new and patentable. Convinced as I am of the very great usefulness of these processes, I believe that such patents would be very valuable. I prefer, however, to give them freely to anyone caring to use them, asking only, in return, to have them ascribed to their author and not appropriated by those who may make trivial modifications on them.

A glue which will resist the action of water is made by boiling 1 pound of glue in 2 quarts of skimmed milk.

Correspondence.

Adjusting Locomotive Valves.

To the Editor of the Scientific American:

I will give you a method for setting slide valves of locomotives, which is practical and easy. Make a steel tram, about $5\frac{1}{2}$ inches long, with two points at right angles with the straight bar, one point to be $2\frac{1}{2}$ inches in length and the other $1\frac{1}{2}$ inches. Both points are to be sharp. Take a center punch, and make a center mark on top of the steam chest packing box; then take a strip of tin and put it in the steam port. Draw the valve slowly back until you can just move the tin between the edge of the valve and the edge of the steam port (which is now closed, except as to thickness of the strip of tin). Take the tram, place the short point in the center mark on the packing box; then make a scratch on the valve stem, and go through with the same process with the opposite steam port. Now you have marks on the valve stem just where the valve begins to open. The valve stem must next be got into radius (as we term it), which is to show the proper length for the valve stem. It is done thus: Cover the steam ports equally with the valve, put the center of rock shaft and the rocker pin at a right angle with the bore of the cylinder; and when the valve stem is adjusted to this, it is of the proper length and should not be altered.

To adjust the valves in forward motion, hook the reverse lever in the forward notch, take the dead points for centers, and alter the eccentric rods until the spaces are equal on the valve stem, which is determined by the use of the tram. Take the forward centers and give $\frac{1}{16}$ inch lead to the valve, for either passenger or freight engine. By adopting this plan the engine will reverse her action promptly. Hook the reverse lever in back motion, and repeat as above.

If the job is to be done quickly, and the eccentrics are in the proper position, it can be done by the travel, in this way: Move the engine slowly forward with steam, take the tram, and trace the movement of the valve on the valve stem until the stem stops; then trace the return movement until that stops. Take a pair of dividers and measure each distance from the valve mark on the stem, to the extreme of the travel line (or where the valve stopped). Alter eccentric rods until the spaces are equal. By these means, you do not require to take the steam chest covers off.

East Saginaw, Mich.

THOMAS M. HAYES.

An Invention Wanted.

To the Editor of the Scientific American:

I would invite the attention of inventive minds to the subject of respirators for miners, to protect them from the foul gases which trouble so many men, especially in coal mines. An invention that would protect them when laboring to subdue a fire in a coal mine would certainly prove a very valuable one, and be the means of saving many lives, and millions of property.

Hazleton, Pa.

C. F. H.

The New British Patent Bill.

The Lord Chancellor's new Patent Bill, briefly described by us a few weeks ago, meets with vigorous opposition in some of the English papers. Among the ablest remarks upon the subject are those given in *Engineering*. In a recent number the editor says: "Contrary to our anticipations, the Patent Bill has passed through committee with all its powers of mischief intact. In spite of the almost unanimous opposition which it has met with out of doors, the only modifications which have been introduced merely relate to matters of detail. Instead of four examiners we are to have six, the referees are to be appointed by the Commissioners of Patents alone, without the concurrence of the Board of Trade, as was at first suggested, and their services are only to be called in when necessary, and not as a matter of course."

The radical vice of the measure still remains; and although it is pretended that the examination clauses have been framed to meet a universally expressed wish, we are quite sure that nothing of this kind was ever asked for by the general body of inventors. It is perfectly notorious that the idea has been fostered chiefly by a small knot of shameless placehunters, who will not be satisfied with any system which leaves them unprotected. By dint of appearing now as members of this society, now of that, and by reading papers here and delivering lectures there, a delusive impression has been created that inventors are really desirous of seeing the system of preliminary examination introduced. We do not for obvious reasons mention these persons, but a careful examination of the various propositions for patent law reform put forward during the last ten or fifteen years will reveal their names. There are of course some advocates of preliminary examination who are perfectly disinterested, having only joined in the cry on purely theoretical grounds. These goodnatured individuals have in all probability never made a search in their lives, and are totally unaware of the enormous difficulty of deciding whether an invention has really been anticipated or not.

The Lord Chancellor has been at great pains to explain that he does not propose any examination as to "utility," but what is the meaning of "frivolous" if it does not include projects which are "useless," in other words, void of "utility"? It is the same thing in another form—an old friend with a new face. Lord Cardwell sneers at an invention (of American origin) which consisted in placing a piece of india rubber at the end of a pencil, so that the person using it could rub out with one end what he had written with the other. This may be "frivolous" or not, but it was a sufficiently valuable patent to be worth a very costly lawsuit, which is well known as the "india rubber tip case." Those who have followed the

question need scarcely be reminded of the case of Smith & Buller, which occupied the Court of Chancery for many days, the costs amounting to about \$20,000, and in which the matter in dispute was a very minute improvement in swivels. So small was the improvement that ordinary observers would not have detected the difference between the old swivel and the new. Large fortunes have been made out of "solid headed" pins, and buttons have raised many to affluence. Only the other day a large technical college was founded and endowed by a philanthropic manufacturer who stated that a very large portion of his princely fortune had been amassed by making steel pens and split rings. The question of frivolity is in some respects more delicate than that of novelty; and when the examiners have once tasted blood, we shall probably find them rejecting as "frivolous" contrivances which, though seemingly insignificant, may have cost a man years to invent, and which the whole of a trade has been in vain endeavoring to produce.

For years past we have done all in our power to warn inventors as to the almost certain results of an arbitrary system of preliminary examination like that embodied in the present bill. We showed some time back, in a series of articles on "Anticipated Inventions," how some of the greatest inventions of the day would most certainly have been refused by any moderately well informed examiner. If inventors permit this bill to pass in its integrity, they will find themselves in the position of the man who made a monster, and was in due time destroyed by it. For a few years we shall have chaos, soon to be followed by the entire abolition of those laws which have done so much to foster inventive talent, and have borne no inconsiderable share in bringing the manufacturing industry of this country to the high position which it now occupies."

The Heliograph.

Through the general introduction of electric telegraphy, and the all but universal adoption of the Morse alphabet, it occurred to Mr. Mance to produce an instrument which is very compact, very portable, easily set up, and easily worked. Although he was first in favor of larger instruments (which are still preferable for permanent stations), he is now convinced that an instrument of the size here described is all that is requisite. The chief objection to the adoption of the sun telegraph is that we cannot command the sun to shine in the same manner that we can control a galvanic battery; and it must be understood that Mr. Mance advocates his system only as an auxiliary to other systems of field telegraphy.

The instrument consists of a light, but firm, tripod stand, similar to those used for prismatic compasses. On the top a plate is moved by a tangent screw which admits of quick and slow motion, and the plate carries on a pin a semicircular ring, which again carries on pivots the round mirror, the silvering of which is removed in the center for the space of a circle about 3-16 inch diameter. To the plate is also attached a simple key, which is pressed down and springs back like an ordinary Morse key. This key is connected with the top rim of the mirror by a steel rod, which can be lengthened and shortened—as occasion may require—by turning the handle and screwing the rod through the small brass bell which secures it to the edge of the mirror.

By means of the last named adjustment and the tangent screw, the glass can be altered, as the ever-changing position of the sun may require.

From 12 to 15 yards in front of the instrument is placed a sighting rod. This rod is to mark a spot exactly in a line with the center of the heliograph and the distant station. A metal stud marks the spot, and a wooden cross piece marks where the flash rests when not directed on the opposite station.

The instrument can be set up ready for working in a few minutes. When the exact position of the distant station is not known, a flash of sunlight must be thrown in the direction of the most likely points, and this must be continued till it is answered by a flash, which indicates that a distant signaling party is on the lookout. Then, after releasing the tangent screw, the glass must be turned to a convenient angle, and the sighting stick must be directed in a line with the distant station by looking through the small aperture in the center of the mirror. When this is effected, the stud must be raised or lowered till it is in the line of vision on a level with the center of the glass and the distant flash, and the short cross piece must be placed at right angles to the upright, about a foot below the stud. After being thus adjusted, the instrument must not be moved.

The spot will be observed gradually to rise or fall, according to the direction in which the sun is apparently moving. The handle of the key, or the tangent screw, or both, as the case may be, must be turned slightly after every two or three words, to ensure, as far as possible, that the center of the spot shall be on the stud when the key is pressed down.

When the sun is rather low in the heavens, and behind the signaler, it becomes more difficult to direct the flash with accuracy. In consequence of the obtuseness of the angle, the spot loses its circular form, and becomes rather dim when reflected on the stick. If it is required to work frequently with the sun in this position, the employment of a second glass on a light tripod stand is recommended.

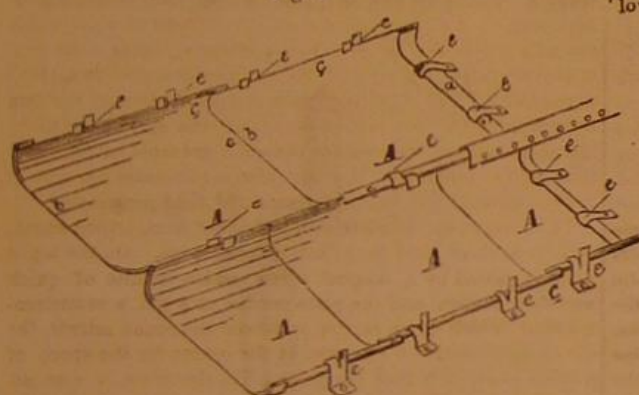
But it would be useless here to enter more into the minutiae of working the instrument: suffice it to say that, in experienced hands, twelve words and more per minute have been obtained. While others state that men—after a fortnight's practice—could attain only from four to five words per minute. As to the distance, 10 and 20 miles—and in very close weather 40 miles—have been obtained.—*Telegraphic Journal*.

SCOTT'S PATENT SHEET IRON ROOFING.

So many conflagrations have been caused by sparks from chimneys, or from adjacent burning buildings, falling upon roofs, that the safety offered by a covering entirely of iron, and consequently fireproof, is by no means unimportant. The device herewith illustrated, while securing that advantage, presents a variety of others which, in brief, render it a most efficient protection. It is portable, and is supplied in plates of eight feet in length by two in width, which are trimmed to fit with accuracy, so as not to get out of line, no matter how great the distance over which they may be run. These plates are provided with side and end connections complete, so that the work of laying them is greatly facilitated. The joints are strong and windproof, and rust or wear by weather is prevented by coatings of pure iron oxide and linseed oil. Finally, it will be noted that nails through the roofing plates are absent, and a frequent cause of leakage thus avoided, and that the peculiar arrangement of plates and seams provides fully for the contraction and expansion of the metal.

A sheet, as supplied by the makers, is represented in Fig. 1. The ends, *a* and *b*, are folded over in opposite directions, the former being uppermost when the plate is in position. The mode of locking together those ends is shown in Fig. 5, from which it will be seen that a continuous water shed is made. The device for attaching the plates to the roof is represented at *c*, in Fig. 5, and also in Fig. 2. This, at the sides of the plates, is an upright iron strip, split part way at the top to hook over the side of the sheet. To admit of this engagement the sheet is bent upward, as represented in Fig. 1, and the curve is such that the edges of adjacent sheets may be in contact and parallel for a short distance. The end cleat is also nailed to the sheathing. To finish the work, the sides are

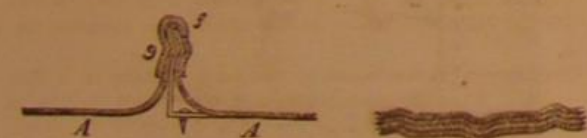
Fig. 2



brought together square at the eaves, and the comb formed, the same as in a standing seamed tin roof, by turning up a two inch standing seam with roofing tongs. In the engraving, Fig. 2, the cap, *f*, which surmounts the adjacent sheet edges, is drawn to the top, so that the fastenings, *c*, can be seen where the sides of the plates meet. The method of securing the parts by countersinking is represented in vertical section in Fig. 3, and Fig. 4 is a horizontal section of the same.

Fig. 3.

Fig. 4



After the roofing plates are all in position, the joints across the ends are closed and compacted by beating the folds together. The invention is applicable to any class of building.

Fig. 5



ings, but particularly to large manufacturing establishments, on account of the slight pitch at which it can be laid, the cost of building being thus materially decreased.

Further particulars may be obtained by addressing the manufacturers, Messrs. Scott & Co., 75 East Front street, Cincinnati, Ohio.

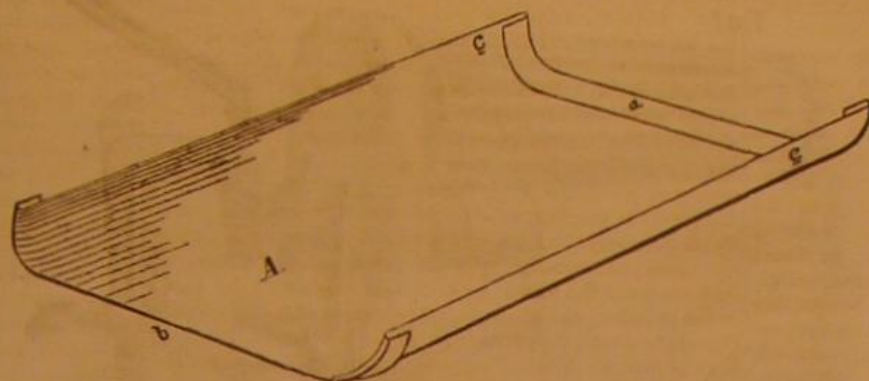
Struck by Lightning.

Mr. D. Pigeon gives, in *Nature*, the following interesting account of the effect of lightning upon himself and members of his family, during a recent thunderstorm: "The house, in which with my family I have spent the winter, stands in the center of Torbay and close to the sea. In the garden, which gives access to the shore, is a flagstaff, 50 feet high, with a metal vane at the top, the mast being steadied at about 25 feet from the ground in the usual way with iron wire guys. About a foot above ground, each wire rope terminates in a $\frac{1}{2}$ inch chain, which is anchored a few feet in the soil.

February 25th, 1875, was a rainy day during the forenoon, with heavy wind from the southeast; but in the afternoon

the sky cleared. There had been no sign of thunder all day. At 5 P.M. my wife, my son, and myself were standing under the flagstaff and within 10 feet of a mooring chain, watching the bay, when the vane was suddenly struck by lightning, which broke the mast short off in two places, tearing and splitting the wood between the vane and the iron guy ropes. Through these the discharge then passed to the ground, but three out of four mooring chains were broken.

The broken mast and vane fell to the ground close to us. Heavy hail followed the flash, the wind falling instantly to a dead calm; a second but distant flash was seen twenty



SCOTT'S SHEET IRON ROOFING.—Fig. 1.

minutes later, after which there was no more lightning. The discharge startled the whole village of Paignton; the coast guard officer compares the explosion to that of a 300-pound gun; and at Torquay, $3\frac{1}{2}$ miles distant, a scientific friend speaks of both flash and crash as most terrific.

I must now attempt to describe the effects on ourselves and the impressions on our senses. Of the three, my wife only was "struck," and fell to the ground, my son and myself remaining erect, and all three retaining consciousness. For more than half an hour my wife lost the use of her lower limbs and left hands, both of which became rigid.

From the feet to the knees she was splashed with rose-colored tree-like marks, branching upwards, while a large tree-like mark, with six principal branches diverging from a common center, thirteen inches in its largest diameter, and bright rose red, covered the body. None of us are certain of having seen the flash, and my wife is sure she saw nothing. As to the noise, my wife heard a "bellowing" sound and a "squish," recalling fireworks; my son also heard a "bellow," while I seemed conscious of a sharp explosion. My wife describes her feeling as that of "dying away gently into darkness," and being roused by a tremendous blow on the body, where the chief mark was afterwards found. My son and myself were conscious of a sudden and terrific general disturbance, and he affirms that he received a severe and distinctly electrical shock in both legs. My left arm, shoulder, and throat especially suffered violent disturbance, but I did not think it was electrical. As I turned to help my wife, who was on the ground, I shouted, as I thought, that I was unhurt, and hoped they were also, but it seems I only uttered inarticulate sounds, and my son, in his first attempt to answer, did the same. This, however, was only momentary; in an instant we both spoke plainly.

Neither of us referred the occurrence immediately to its true cause, but the idea of being fired at was present to all our minds, my wife indeed remained of opinion that she was shot through the body until she heard me speak of lightning. An infinitesimal lapse of time enabled my son and myself to recognize lightning; but I cannot say whether I did so before or after my first glimpse of the wreck on the ground. Neither of us heard or saw the mast fall, though it descended fifty feet, and fell on hard gravel close to us. My son and myself both experienced a momentary feeling of intense anger against some "person or persons unknown," further showing that we preliminarily referred the shock to some conscious agency. I ought perhaps to add, that neither of us felt any sensation of fear at the time; but we were all nervous for several days after.

I have endeavored to keep to fact throughout, but I venture to add a remark made by my wife as we raised her from the ground: "I feel quite sure that death from lightning must be absolutely painless;" and I offer it as an unconscious corroboration of views on this subject which our experience seems to strengthen.

The Use of the Hand as an Optical Instrument.

Dr. F. Thomas, of Ulm, observes that, although artists are well aware of the advantages of monocular vision and the use of the hand as an impromptu stereoscope for the inspection of pictures, the public generally knows nothing of them. Any one who carefully watched the crowds that daily thronged the avenues of the late Vienna Exhibition might have seen how very, very few persons amongst them ever availed themselves of this ready resource.

And yet, how different is the appearance of a really good picture thus seen and the same viewed in the ordinary way by binocular vision! Regarding it with a single eye through the hollow of the hand as through a stereoscope, we get a relief, a substance, which otherwise is more or less wanting; in a word, we get the third dimension, depth, which is indispensable to realistic effect. Nor is the method applicable to the contents of picture galleries alone; every photograph, every engraving and print, of correct design, may be beneficially treated in the same way. As with the stereoscope, so with its impromptu substitute, we get increased focal length,

and with it the several artistic advantages thence accruing. On the other hand, defects in drawing are ruthlessly exposed by the same means. Trifling errors in perspective, which might have passed unnoticed under ordinary circumstances, stand revealed in their full deformity.

With juster perceptions of the magnitude and relative dimensions of objects, monocular vision, combined with the stereoscopic use of the hand, gives us, also, a correcter appreciation of the effects of reflected light. And this applies not only to the confused appearance occasioned by the interposition of highly reflective media between the object and the observer, but also to artificial reproductions of the same effect.

A point ignored in every treatise to which Dr. Thomas has had access is the effect of the hand, when thus used, in modifying or correcting our perceptions of color. The rays of the setting sun are flooding the landscape with golden light. Prominent in the distance stands forth a church tower lighted up with a rich orange glow. By regarding it attentively through the hollow of the hand, and opening and closing the latter suitably, the tower can be made to assume any intermediate tint between the white it really is and the orange it has assumed in the rays of the western sun. The woods, too, dark, somber, and night-like to the unaided vision in like manner can be made to resume the

hues they wore in the broad light of noonday. A bright patch on the far distance shows a soft subdued white, and we notice then for the first time that to the unassisted eye it presents a bright golden color.

Indeed, our conceptions of color are mainly dependent on comparison—contrast. But these are quite inadequate to enable us, under all circumstances, to detect and discriminate between minor differences of shade by ordinary unaided binocular vision. For that purpose, we must have recourse to the hollow of the hand, looking through it at the object with one eye, and comparing the effect observed with that produced on the other and unshaded eye. Both eyes may be open.

In such cases, the chief point is not monocular vision, but the shading of the eye by the hand thus applied. As with a Nicol's prism, we thus restore the equilibrium of the blue light diffused through the atmospheric regions—which in the landscape above referred to was overpowered by its complementary color, the orange emanating from the sinking sun—and are so enabled to see objects under the hues they would present when viewed by the white light of a noontide sun.

Phosphureted Steel.

A year or two ago, it was generally admitted that a pure ore or pig iron, and especially one containing less than 0.03 to 0.05 of phosphorus, was absolutely essential to the production of a good Bessemer steel; the consequence has been that many of our richest iron ores, most cheaply mined and supplied, have been ruled out as unfit for Bessemer work. Such are most, if not all, of the limonite and fossiliferous ores of Pennsylvania, Virginia, Tennessee, Georgia, and Alabama, in which the percentage of phosphoric acid runs usually from 0.05 to 0.15 per cent, corresponding to about double these amounts in the pig iron. This small percentage of phosphorus has been a perfect bugbear to iron manufacturers, and so important was it considered that one of our large steel works imported 10,000 tons of ore from Algiers at a cost of about \$16 per ton, because it was, at that time, impossible to procure ores here sufficiently free from phosphorus for use in the manufacture of steel rails. Innumerable efforts have been made to get rid of the phosphorus in the several processes through which the iron passes in its manufacture, but these efforts have been but partially successful, and then only in the puddling process, and, consequently, of no use in the manufacture of Bessemer steel.

Investigations which have been made during the past two or three years have developed the fact that, by a kind of homeopathic treatment (*similia similibus curantur*), certain substances which themselves give hardness and brittleness to steel may be in part substituted for other ingredients having a similar tendency, to the great improvement of the resulting metal. It has thus been found that, by securing proper relative proportions of carbon, phosphorus, silicon, and manganese, a steel of great softness and strength can be obtained, while the same percentage of phosphorus in ordinary steel would have indicated very different properties.

There is no longer much doubt of the fact that manganese exerts upon steel a body-giving and toughening influence, as well as a neutralizing effect, on the hardening or cold-shortening due to phosphorus. Though these properties of manganese have been blindly suspected for some time, the mutual dependence and, to a certain extent, interchangeability of carbon and phosphorus were not fully appreciated till the success of M. Tessié Du Motay, in producing, with ferromanganese, a good rail steel containing about 0.12 carbon, 0.25 phosphorus, and 0.75 manganese, was fully established.

The secret of success appears to be in putting into the metal from three quarters to 1 per cent of manganese without bringing the percentage of carbon above 0.16, while the metal contains the ordinary amounts of phosphorus and silicon, or, say, 0.25 to 0.29 of the former and 0.03 of the latter. When the percentage of phosphorus is diminished, that of carbon should be increased, and vice versa, within certain limits. Steel is undoubtedly destined to supplant iron for almost every use where the latter is now adopted. Our ironmasters should apply those improvements that will place us in a position to compete successfully in other markets than our own.—*Engineering and Mining Journal*.

IMPROVED WASHING MACHINE.

The annexed engraving represents a new washing machine which may be readily attached to any kind of tub. It is operated by passing the clothes between a corrugated roller above and an endless belt, which envelopes smaller rollers, beneath, the upper roller being held in its place and against the garments by stout spiral springs, and rotated by the handle shown.

In the illustration, A is the upper roller, which is faced with sheet metal. In Fig. 2, the arrangement of the smaller rollers and belt beneath is clearly shown. One of the springs which hold the roller, A, down upon the clothes is represented at B, and the simple screw clamps, by which the device is attached to the tub, need no special description, except to note the fact that they, in common with other metal work of the machine, are strongly constructed of galvanized iron, and are pivoted to the frame portion at C, so as to be adjusted on the circular edge of a tub.

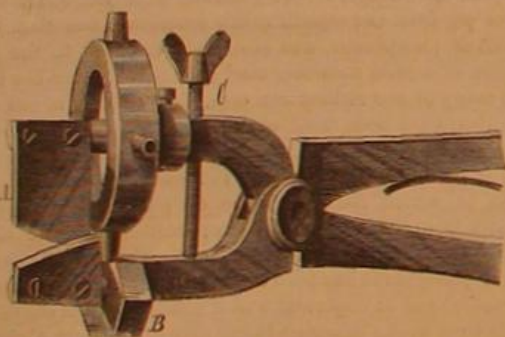
The garments, as they pass between the rollers, are thoroughly rubbed by the upper one, receiving the same scouring as if rubbed by hand upon an ordinary washboard. The springs admit of the upper roller adjusting itself to any thickness which may be passed beneath it.

This machine is also claimed to wash the lightest fabrics with much less wear than is produced in washing by hand.

Patented February 24, 1874. For further particulars relative to sale of State, county, and town rights, address Mr. James Taylor, P. O. Box 44, Otter River, Mass., or Box 577, Stamford, Conn.

WOLFF'S BUTTON HOLE CUTTER.

The device represented in the illustration is a handy little instrument which cuts a slit for a buttonhole and, at the same time, punches the rounded end of the same. The handle resembles an ordinary pliers, and at the ends of the jaws two curved cutting blades, A, are attached. Just inside the blades, and on one jaw, is a circular head, attached as shown, and carrying several punches of various sizes. On the other jaw is a rotary anvil, B, corresponding in its sides to the shapes of the punches. The length of the button hole depends upon the distance to which the curved blades are permitted to pass each other. The length is regulated by the punches being adjusted in their head, so that, if one of them is brought opposite to the anvil, it will strike the



same and prevent the cutting blades passing beyond the desired distance. In one of the jaws is secured a set screw, C, which is so adjusted that it keeps the punches from striking too hard against the anvil. When buttonholes are to be made without eyelets, the punches are turned out of the way, and the length of the cuts determined by the screw, C. Both the cutting blades and the punches can be easily removed for sharpening or replacing them by new ones. Patented April 7, 1874, to Mr. Raphael Wolff, of New York city.

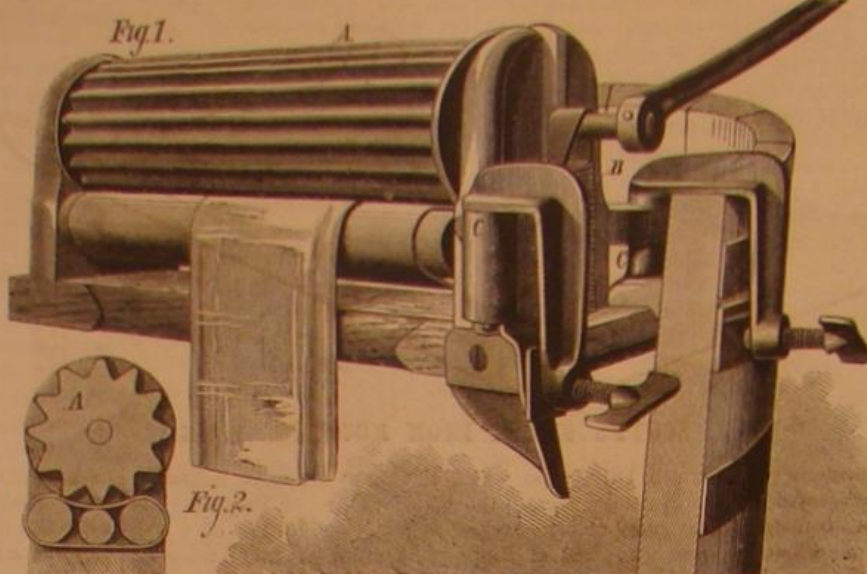
New Process of Dental Surgery.

Mr. Napier, an English dentist, announces what he considers to be something new in dental surgery, especially in a case where the teeth were extremely sensitive, and it became necessary to file them down for the purpose of introducing artificial teeth on the stumps. For the sake of avoiding pain in the operation as far as possible, ether spray was first made use of in reducing the sensibility of the teeth; a piece of cotton, dipped in ether, and laid first on the teeth and then on the instrument, being found to answer a still better purpose. While engaged in this operation it occurred to Mr. Napier to avoid the usual practice of dentists (of extirpating the nerve), with which object he took a bit of hard wood, dipping it in nitric acid, and with this cauterizing the exposed portion of the nerve in each tooth successively. He then filed the teeth down to the level of the gums without producing any pain whatever. He found that in this way the stump of the tooth remained perfectly healthy, giving no pain of any kind; and the subsequent experiences of the patients were of the most satisfactory character.

PROFESSOR SERGIUS KERN, of St. Petersburg, finds that the explosive properties of nitro-glycerin nearly disappear if the substance is highly heated.

The Siemens Furnace Anticipated.

Some two years ago, we gave a drawing of the medical warming apparatus, which the Prussian patent authorities decided to be an anticipation of Dr. Siemens' regenerator. A recent number of the *American Gaslight Journal* contains an article by Professor B. Silliman, who certainly ought to be made a Patent Office examiner on the spot, in which he endeavours to show that the gas furnace was foreshadowed in Dr. Hare's oxyhydrogen blowpipe! "Properly considered," says Silliman, "the fundamental principle which led Hare to the



TAYLOR'S WASHING MACHINE.

oxyhydrogen blowpipe has also led Siemens, in our time, to the invention of the regenerative gas furnace, by which, as Hare says in his memoir, 'to avoid these evils,' that is, the contact of solid fuel and the loss of heat consequent on its conversion into gas, it was thought desirable that means might be discovered of clothing the upper surface of any body which might be subjected to this species of operation with some burning matter, of which the heat might be equal to that of the incandescent carbon with which the lower surface might be in contact; or by which bodies might be exposed on solid supports to a temperature equal or superior to that of the porous charcoal uniting with oxygen. It soon occurred that these desiderata might be attained by means of flame supported by the hydrogen and oxygen gas. In the Siemens furnace the objects to be heated are sustained on a solid support in an atmosphere of burning gas, the oxygen of the atmosphere arriving by one inlet, and the combustible gases by another, and the two uniting in a true Hare's blowpipe flame to do their work. The necessary contrivances for the alteration of the flow of gas and air through the regenerative cellular flues of firebrick are evidences of a high degree of inventive skill, applied to the solution of a problem which, in its essential features, was clearly set forth by the American philosopher, Robert Hare, in 1802."—*Engineering*.

Electrical Colored Shadows.

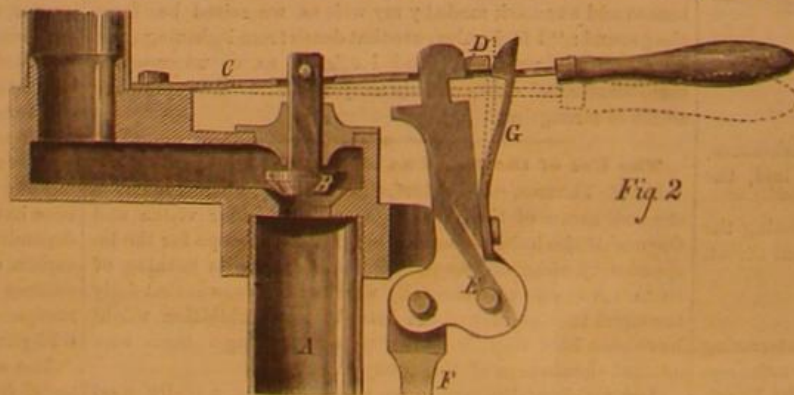
Six Grove's cells were connected with one of Ladd's large induction coils, and the secondary current, condensed by two large Leyden jars, was sent, in the usual way, between two pairs of metallic electrodes, in order to examine their spark spectra.

Two of the electrodes were of platinum: these may be called pair A.

Of the other pair, B, one electrode was of platinum, and the other of the metal to be examined.

Place a piece of white paper equidistant from, and on one side of, the two sparks. Hold the finger so that a shadow of it may be cast by each spark. The two shadows will be seen to be most beautifully tinted with different delicate colors, varying according to the metal inserted in B.

It will be seen that the shadow thrown by A is lighted by B, and is seen on a ground jointly illuminated by A and B; while B's shadow, lighted by A, is seen on the same common



HOPKINS' LOW WATER INDICATOR.

colored ground as before. Without these considerations, it might have been supposed that the shadow thrown by B, and lighted by the unchanging spark A, would itself have remained unaltered. "I saw it of the colors, pink, light pink, dim pink, light green, nearly white, and yellow green; corresponding to the introduction into B of Bi, Ag, Sn, In, Al, and Mg respectively."—C. T. L. Whitwell, in *Nature*.

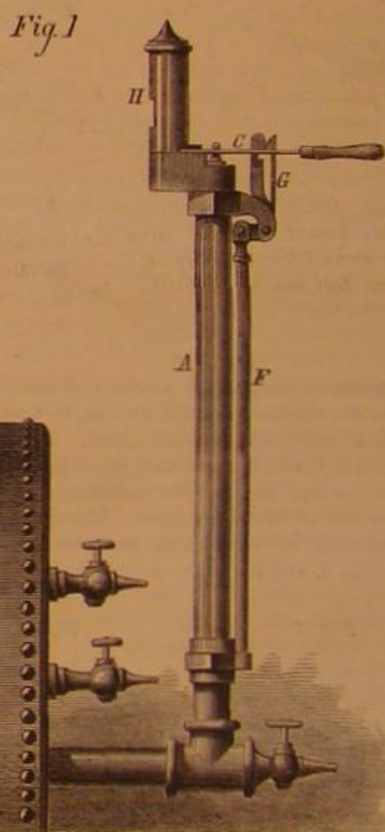
IMPROVED LOW WATER INDICATOR.

The invention illustrated in the annexed engraving is a new low water indicator which, it is claimed, can never get out of order so as not to give an alarm. The foaming of the boiler, it is stated, in no wise prevents the proper action of the device. The apparatus is, besides, simple in construction and possessed of various other advantages which will be readily understood from our engraving and the following description.

Fig. 1 shows the indicator as attached to the boiler and Fig. 2, the mechanism of its upper portion. A is an expansion tube connected to the generator at the alarm line, and provided at its upper extremity with a valve, B, the stem of which runs through a spring, C, Fig. 2. One end of the latter is fixed, and across a slot in its forward portion a bar, D, is placed. E is a detent or right angled lever, pivoted as shown in Fig. 2, one arm of which connects with the rod, F. The long arm extends upward through the slot in the spring, and is notched in such a way that, when the expansion tube, A, is cold, the crossbar, D, rests in the recess, thus retaining the spring, C, when depressed, and consequently holding the valve in its seat. To the lower part of the lever, E, is fixed a spring catch, G, which has its nib a very small distance below the notch in said lever. Rod, F, is fixed in a casting in the lower end of the expansion tube, and at H is a whistle.

The operation of the device is as follows. When the water is at its proper height, the tube, A, remains cool, the crossbar, D, rests in the notch of the lever, and the spring catch, G, rests against the side of the bar.

On the water in the boiler falling below the alarm line, the water in the expansion tube runs out and steam takes its place, expanding said tube which, in lengthening, raises the lever, E. The short arm of the latter being held by the rod, F,



the long arm is thrown over, the notch slips off the crossbar, the spring raises the valve, and the steam, escaping, sounds the whistle.

To stop the alarm it is only necessary to depress the spring by means of its handle. The catch, G, then engages with the crossbar, D, and, retaining the spring, holds the valve to its seat. When the water in the boiler again reaches the proper level, the tube, A, quickly cools, and in contracting throws the lever, E, over, so that the notch engages with the crossbar. At the same time the catch, G, is displaced, and the spring is thus allowed to rise sufficiently to admit of the engagement just mentioned. If it is desired to blow dry steam through the whistle, the upper end of the pipe, A, can be plugged and steam taken through a separate pipe below the valve. The device may also be placed in a horizontal position, and the whistle dispensed with, a nozzle being used in its place. The apparatus then becomes an automatic gage cock.

Patented November 10, 1874. For indicators or for further information address Messrs. Hopkins & Tytler, manufacturers, Albion, N. Y.

THE meeting of the British Social Science Association will be held at Brighton in October next, and there will be an exhibition of appliances and apparatus relating to the sanitary and educational systems.

NOVEL DEVICE FOR PREVENTING RUNAWAY HORSES.

The annexed engraving, for the description of which we are indebted to the *Peith Wochenblatt für Land und Forstwirtschaft*, represents an ingeniously simple device for checking runaway horses. A A are stout rings, of sufficiently large diameter to slip over the fore legs of the animal and close up to the body. They are held in the last mentioned position by lines, B, which lead up through leaders on the saddle, and are joined to a single ring which slips over a hook, C, on the dashboard. Thus arranged the device forms no impediment to the horses' motion, as the rings, though connected together between the legs, are joined by a sufficiently long bond. In case of the animals' running away, however, the driver has merely to lift the ring for the hook, C, and allow the large rings, A, to descend lower down on the legs. This of course interferes at once with the horse's stride. If it be necessary to bring them to a sudden halt, to avoid immediate danger, the supporting lines are let go altogether. The rings then fall to the horses' feet, restricting their further progress, and perhaps throwing the animals. This would probably result in injury to the latter, but it would not be employed except to prevent instant accident to the occupants of the vehicle; and it is possible their lives would be more imperiled by the sudden stoppage than if the appliance were not used. But the idea is novel, and some one, no doubt, considers it practicable, and perhaps it is.

The Tallest Chimney in the World.

The tallest chimney in the world is the Townsend chimney, Glasgow, Scotland. It was built by Robert Corbett, of Glasgow, for Joseph Townsend, of Crawford Street Chemical Works. The total height from foundation to top of coping is 468 feet, and from ground line to summit, 454 feet; the outside diameter at foundation being 50 feet, at ground surface 32 feet, and at top of coping 12 feet 8 inches. The number of bricks used in the erection were as follows: Common bricks in chimney, 1,142,532; composition and fire bricks for inside cone, 157,468; common bricks for flues, etc., 100,000; total, 1,400,000. The weight of bricks at 5 tons per 1,000 is equal to 7,000 tons. When within 5 feet of completion, the chimney was struck by a gale from the northeast, which caused it to sway 7 feet 9 inches off the perpendicular, and it stood several feet less in height than before it swayed. To bring back the shaft to its true vertical position, "sawing back" had to be resorted to, which was performed by Mr. Townsend's own men, ten working in relays, four at a time sawing, and two pouring water on the saws. The work was done from the inside on the original scaffolding, which had not been removed. Holes were first punched through the sides to admit the saws, which were wrought alternately in each direction at the same joint on the side opposite the inclination, so that the chimney was brought back in a slightly oscillating manner. This was done at twelve different heights, and the men discovered when they were gaining by the saws getting tightened by the superincumbent weight.

THE LITTLE DODO OR DODLET.

A great many very interesting additions have recently been made to the collection belonging to the Zoological Society of London, and are now to be seen in their renowned gardens in the Regent's Park. Among them is a bird variously styled the didunculus, dodlet, little dodo, and toothed billed pigeon, the scientific name for which is the *didunculus strigirostris*, which was brought from the Samoan Islands. The bird was not unknown in Europe, a specimen having been sent thither in 1864; and from its size, dark plumage, and terrestrial habits, it might be mistaken, at a little distance, for some species of moorhen, but a closer inspection of its structure convinces one of its relationship to the pigeons.

The head and upper portion of the neck and breast, says the *London Field*, to which we are indebted for the annexed engraving, are of dark slaty green color, the primaries the same, but somewhat paler; the rest of the plumage chocolate brown; the face and throat bare, and of a dark flesh color in the young bird, approaching to orange in the adult. The bill, which is remarkably deep, and with the upper mandible dentated, is orange yellow in the young bird, and red in the adult. The legs and feet are

also red. In the contour of the bill, the form and position of the nostrils, and several other characters, the didunculus differs from any other living species at present known; and, although a smaller bird in size, it approximates most nearly, in all its characters, to the extinct dodo, and, like it, combines the character of a rapacious bird with that of the harmless pigeon.

It will be seen that the mandibles of the didunculus are powerful in structure, yet, according to Dr. Bennett, the beak is never used as an offensive weapon; for when the hand is



DEVICE FOR CHECKING RUNAWAY HORSES.

placed in the cage, or the bird is seized for removal from one cage to another, it never attempts to bite its captor, but, on the contrary, is so timid that, after fluttering about or running into a dark corner of the cage in its efforts to escape, it soon becomes subdued, and is easily taken. This statement, however, requires some modification; for, according to the Rev. S. J. Whitmee, a resident at Samoa, who has kept the bird in confinement there, it is sometimes "exceedingly savage. When any one approaches the cage," he says, "it ruffles its feathers, trembles, apparently with rage, and tries to bite. If it gets hold of one's finger," he adds, "I know from experience that it gives a severe gripe."

In size, the bird may be compared to a large pigeon, which it resembles in some of its habits, and in the nature of its food. Like some of the Australian pigeons, it flies with a loud noise, which is especially noticeable as the bird rises on the wing. Like the ground pigeon, it nests or roosts on bushes or stumps of trees, and feeds on the ground. Its food consists of plantains and the fruit of the *soi*, a kind of yam, not unlike a small potato.

THE LITTLE DODO (*didunculus strigirostris*).

Preventable Diseases.

It being conceded by every sensible person that good health is paramount to all other human blessings, we take frequent occasion to transfer to our columns (from reliable sources) practical information tending to promote and preserve the blessing so essential to all. To *The Herald of Health*, for April, we are indebted for the following:

"The range of what are called preventable diseases is now known to be very wide, and all such diseases it should be the first duty of man to prevent. Much of this—that for which I especially wish to ask attention—is not only preventable disease, but is disease that is called into existence only by the act or by the neglect of man; and it is not too much to say (after the thorough investigations of the subject that have been made by sanitary authorities) that there has never been a case of typhoid fever that was not almost directly caused by the ignorance or by the criminal neglect of some person whose duty it should have been to prevent it. Such disease never comes without cause; and its cause is never anything else than organic poisoning, arising from organic decaying matter or from the spread of the infection directly from a patient suffering from the disease.

Typhoid fever has many names, all of which are suggestive of its origin. It is called "drain fever," "sewer fever," "cesspool fever," "foul well fever," "nightsoil fever," etc.; and it is never caused except by the introduction into the system of the germ of the disease—which can originate only through the operation of neglected organic wastes, or by communication through the lungs or stomach by means of foul air or foul water, or from germs arising from the persons or from the excreta of typhoid patients. So far as its contagion is concerned, ample ventilation of the sick room and the immediate removal or disinfection of the feces are ample preventives. It is not contagious, as smallpox is, but is spread by the action of germs which infect the locality of the patient, and extend more or less widely according to the precautions used to confine it. There is not necessarily the least danger that the disease will attack even the constant attendant of the patient, if proper care is taken.

With the householder himself rests the entire responsibility of the origin of every first case breaking out in his household. This is a certain and thoroughly well established fact, and there attaches to him the full measure of guilt for every such case. This is a responsibility for which the community should hold him strictly accountable. It would really be as correct to ascribe a red-handed murder to Providence as to attempt in this way to console ourselves for a fatal attack of typhoid fever. We are taught that we shall not cleave our child's skull with an ax, and that if we do, death will surely result; but we are no less absolutely taught that we shall not poison our child's blood with the foul emanations of our house drains and with the contamination of our drinking water wells, lest the same fatal result follow. We may ignorantly load the water with which our families are supplied with lead poison, and so be without the guilt of intention; or we may ignorantly poison our wells by the infiltration of infected organic matter, and in this case, as in the other, be acquitted of the charge of criminal intent. But in these days, when so much has been published concerning the origin of diseases of this class, however free we may be of all criminal intent,

the serious charge of criminal neglect must surely lie at our door.

It may be assumed, without hesitation, that, whenever a pronounced case of typhoid breaks out in an isolated country house, or when any form of low fever occurs, though it may fail to assume a distinct typhoid character, there is in that house, or about it, or in connection with its supply of drinking water, some accumulation of neglected filth, some pile of rotten vegetables in the cellar, some overflow from a barnyard, some spot of earth saturated with the slops of the kitchen or some other form of impurity, to which the origin of the disease may be distinctly traced. The spread of typhoid is very generally occasioned by germs contained in the bowel discharge of fever patients; but the disease is constantly originating itself where no such cause exists, and every first attack is a plain indication that either at home or in some house at which the patient has visited, one or two things have occurred: (1) there has been an exhalation of poi-

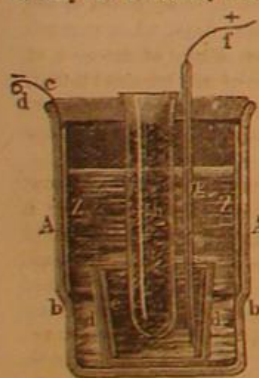
noxious organic gases from a kitchen yard, from a neglected cellar, or from some other source of bad air, which has entered the lungs and planted there the germs of the disease; or (2) either in the food or in the drink of the patient, these germs, originating in the same organic putrescence, have found their way to the stomach. In either case the blood is attacked; the subject may have been sufficiently robust and vigorous, or sufficiently unsuceptible to infection, to have avoided a serious or fatal illness; but in every instance the danger has been incurred, and, when incurred, the risk must be the same as in taking any other form of slow poison. This is not theory, but simply a well established fact, demonstrated by long, careful, and frequently repeated investigation. The precise character of typhoid infection and the exact manner of operation when introduced into the blood, are not known; but that it always originates in the way described, and that it may invariably be prevented by the use of proper sanitary precautions, is absolutely known.

This being the case, it lies perfectly within the province of every farmer (and if the farmer will not attend to such matters of his own accord, his wife has a way of urging him into it) to remove, while it is yet time, any source of infection to which his house may be liable. Vegetables in any considerable amount should not be kept in the house cellar, and at least once a week the floor of the cellar should be swept and every shred of waste vegetables removed. Even when this is done, the cellar should be ventilated by a window or other small opening toward the quarter least exposed to cold winds (and in summer on every side); the privy, if a privy is used, should be well away from the house, and especially far from the well, unless its contents are received in a tight box and entirely absorbed by dry earth or ashes, and even then frequently removed; the chamber slops of the house should never, under any circumstances, be thrown into the privy vault, nor into a porous cesspool, from which they can leach into the ground and through the ground for a long distance into the well, or into and around the foundation of the house. The same disposal of the liquid wastes of the kitchen is desirable, but not so absolutely important. It is, however, important that this should be led by an impermeable drain to a point well away from the house and from the well; and all manner of nondescript refuse material, such as is sloughed off by every household in the ordinary course of its living, should be removed at least daily from the near vicinity of the dwelling, and the vessels in which it accumulates should be frequently cleansed and aired; manure heaps should not be left to ferment and send off their exhalations at a point whence frequent winds waft them toward and into the dwelling, nor should the barnyard be allowed to drain (either over the surface or through a porous soil) toward the house or well. If all these precautions are taken, the well will be tolerably safe, and in most cases absolutely safe; but if there is any doubt on the point, then let no well water be drunk except after boiling; or the drinking water of the house may be taken entirely from a filtering cistern, of which the filtering bed is sufficient to hold back all organic matter.

If all these points are well attended to, and if the ordinary rules of cleanliness be observed in the household, the members of the family may be considered as safe against attacks of typhoid fever.

THE MEIDINGER BATTERY.

The Meidinger element is a modification of the Daniell battery; but it has no porous cell, and possesses greater durability and constancy of current. It consists, as shown in



the engraving, of a glass vessel, A A, 8 inches high and 5 inches wide, in the bottom of which is placed a small glass vessel, d d, of half the dimensions of the larger glass, cemented in with rosin. A zinc disk, Z Z, which is supported upon a ledge of the outside vessel, surrounds the smaller glass. The inside wall of the smaller glass, d d, is covered by a sheet of copper, e, on the lower end of which an insulated copper wire, g, is riveted. The mouth of the vessel is closed by a wooden or tin plate having an opening in the center for the reception of a glass cylinder, h, 1 1/2 inches in diameter and 8 inches high, narrowing towards the lower end, which is rounded and in which a hole is made. This tube is sunk to the center of the small glass, d d. The entire vessel is filled up to the zinc disk, about 1 1/2 inches below the upper brim, with a diluted solution of Epsom salts. The glass cylinder, k, in place of which a glass funnel can be used, is filled with crystals of sulphate of copper, forming a concentrated solution, which, being a heavier fluid, sinks down through the small hole in the glass tube, and fills the small glass, d d, to the center.

There is very little diffusion of the copper solution upwards, or out of the little glass vessel, d d, to the zinc disk, Z, even when the battery is not in operation; so that, after the lapse of several weeks, the zinc scarcely shows any signs of being affected by the copper. The battery is therefore much superior to the ordinary Daniell battery, which, when the circuit is open, produces a great diffusion of the sulphate of copper through the porous cup.

The zinc is usually amalgamated on its inner side, enabling its impurities to be easily removed, which would otherwise form a hard crust. If the copper wire, g f, which is riveted to the copper sheet, e, is connected with a small strip of cop-

per, e k, soldered to the zinc disk, we obtain a galvanic current having an electromotive force equal to that of a Daniell cell, and it remains constant as long as there is sulphate of copper in the glass tube, h; and the zinc, Z, is not dissolved. During the activity of the battery, in fact, the solution of sulphate of copper increases a little in quantity, in consequence of a diffusion which is caused by the overflowing (in the smaller glass, d d) of the heavier sulphate of zinc solution formed by the dissolution of zinc. By the action of the current, the greater part of the copper is deposited on the upper half of the copper plate. A trace of copper, however, appears upon the zinc, but frequently this is after several weeks' operation. The duration of the battery depends on the size of the glass vessel. A battery of the size described (according to Meidinger's statement) ought to be taken to pieces and the solution of Epsom salt and sulphate of zinc drawn off, and pure water put in it as soon as it has consumed 3 lbs. of sulphate of copper, which, however, may take a year.

The resistance of this cell considerably exceeds that of the Daniell battery with porous cells; but for a line battery, where the resistance in the wire is very considerable, this is of no special importance. Meidinger recommends, for main lines, cells 5 inches high and 3 inches wide; while the battery of the size depicted in our engraving is intended for local use and for line batteries of small resistance. As a local battery for the Morse telegraph, it is best to use six cells, two of which are connected with like poles, so that we have, practically, three elements with enlarged surface and conductivity.

Generally, in charging the Meidinger element, a solution of 1 part Epsom salts to 4 or 5 parts of water may be used. In proportion to the activity of the battery and the consumption of the sulphate of copper, fresh crystals of this salt should be added to the contents of the glass funnel. But when the surface of the fluid has sunk by evaporation, soft water only need be added to the glass funnel. An improvement has been obtained in this element by having the funnel-shaped sulphate of copper vessel entirely closed at the top. After the jar, h, has been charged with crystals of sulphate of copper, a solution of Epsom salts (sulphate of magnesia) is added thereto.

The Meidinger battery is valuable wherever long duration and a current of moderate but constant strength is required, and especially for operating the Morse telegraph, electric clocks, hotel telegraphs, and electric bells. The chief condition for its successful use is that it shall not be shaken, as shaking causes a mixture of the fluids, and in this way destroys its action and the constancy of the current. Its faults consist in the liability that the tube, h, may be filled up with sulphate of copper (either from impurities of the salt or from precipitation of metallic copper) or crystals of sulphate of zinc, so that the action of the element ceases; and partly because the flow of the solution of sulphate of copper from the tube to the lower edge of the zinc cylinder rises, and then, at the least diffusion, the sulphate of copper attacks the zinc. When this happens, the sulphate of copper is decomposed by the zinc, a superfluous quantity of sulphate of zinc is formed in the fluid, and metallic copper is precipitated in the form of a brown, spongy powder upon the zinc cylinder. This battery is extensively used upon the Austrian telegraph lines.

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

Beef bones, boiled in water for some hours with rock salt and a little alum, yield a size which can be used in the preparation of cotton and silk goods.

The clatter and risk of glass in carriage windows can be prevented by placing, at the bottom of the casing, an arched piece of india rubber.

Unless the mouth is frequently and carefully cleansed, it becomes infested with vegetable and animal parasites. These cause decay of the teeth. Soap is the best material for preventing the development of the fungi and for neutralizing the acid. Precipitated chalk mixed with the soap assists the cleansing action.

The following practical hints on ballooning are published by Donaldson the aeronaut, in a little paper edited by him and named the *Aerial*. The lifting strain of a balloon is principally on the net. If a balloon will stand inflation, it is safe in mid-air. In winter, the atmosphere is warmer one mile above the clouds than it is at the earth's surface. The weight of a balloon to carry one man, including net and basket, should not exceed 80 lbs. A cotton balloon will last for about sixty ascensions. A balloon thirty feet in diameter undergoes a strain of 1 1/2 lbs. to the square foot of surface. Gas, which at the earth fills the bag only half full, will, at an elevation of 3 1/2 miles, expand so as to fill it completely. One thousand feet of coal gas will raise 38 lbs. Gas which gives a poor light is the best for aerostatics. Kites can be used to steer balloons by sending them up or lowering them into currents of air traveling in different directions from that in which the balloon is sailing.

To make green gold, melt together nineteen grains pure gold and five grains pure silver. The metal thus prepared has a beautiful green shade.

The following recipes for metals resembling gold are said to produce a metal which will so nearly approximate the genuine as almost to defy detection without a resort to thorough tests: Fuse, together with saltpeter, sal ammoniac, and powdered charcoal, 4 parts platinum, 2 1/2 parts pure copper, 1 part pure zinc, 2 parts block tin, and 1 1/2 parts pure lead. Another good recipe calls for two parts platinum, 1 part silver, and 3 parts copper.

Cement for sealing fruit cans is made of resin one pound, tallow one ounce.

DECISIONS OF THE COURTS.

United States Circuit Court—District of New Jersey.

PATENT HARNESSES TRIMMING.—WILLIAM M. WELLING vs. THE RUBBER-COATED HARNESSES TRIMMING COMPANY, ANDREW ALBRIGHT, AND L. C. VOORHEIS.

[In equity.—Before Nixon, J.—Decided May, 1874.]

NIXON, J.: This is a suit for an alleged infringement of letters patent No. 57,941, and bearing date March 15, 1865, granted to the complainant for "a new and useful improvement in rings for martingales;" and the questions in issue are determined by the construction and scope to be given to the specification and claim of said patent.

The schedule annexed is dated April 5, 1862, and the complainant therein states his invention as follows: "In letters patent granted to me August 4, 1857, a composition and mode of making facitious ivory is set forth, and out of said materials I have manufactured billiard balls, rings of various kinds, etc. My present invention does not relate to any particular composition, as that in the aforesaid patent, or any similar compound, may be employed.

The nature of my said invention consists in the employment of a metallic ring within a ring formed of artificial ivory or similar materials, for giving strength to the same, thereby producing a new article of manufacture, and one that is stronger than an ivory ring, and possesses all the beauty of appearance, and can be afforded at a very much less cost. Ivory rings—particularly such as used for martingales—require to be made out of very solid ivory in order to be sufficiently strong, and hence are quite costly.

In order to make my improved rings, I take a ring of metal such as shown at A, or said ring may be formed by punching out a washer from a sheet of metal or in any other suitable way. I take the amount of ivory composition used, by dies or by hand, causing the fair ivory to completely envelope the said ring with as much uniformity as possible, and, to give the exterior finish to the same, press and solidify the mass of composition around the ring by means of dies, and in so doing, any plain or more or less ornamental shape may be given to the said ring or the surface thereof. My ring is thus made of the desired ornamental appearance, while great strength is attained at very little cost.

With a claim, and desire to secure by letters patent, is the ring for martingales, etc., manufactured as set forth, with a metal ring enveloped in composition, as and for the purposes specified."

It is insisted by the defendants that, if the patent is valid at all, it must be limited to a "martingale ring intended to imitate ivory, and made by covering a metallic ring with artificial ivory, such as is described in complainant's patent of 1857, or some similar compound." Bearing in mind the established American rule that patents are to be construed liberally, and are not to be subjected to a rigid interpretation, I think that the construction is too narrow, and does not give to the patentee all that he is entitled to, under the specifications and claims of his patent. It is quite clear, indeed, that facitious ivory was the composition uppermost in his thoughts. Having the partiality of a parent for his offspring, he naturally imagined that no superior compound could be formed or used. It may be conceded that the full extent of his invention had not dawned upon him. Men often build better than they know; but where the fair inference to such construction is employed to describe an invention or discovery includes matters not in the mind of the patentee at the time, he is as fully authorized to claim the unlooked-for as he is the anticipated result.

I am of the opinion, on the whole case, that the claim of the complainant's patent, fairly construed, is not to be limited to the use of facitious ivory; that it is broad enough to include the composition of rubber or gutta percha, and that there should be a decree for the complainant according to the prayer of his bill.

[Frederic H. Betts, for complainant.]

J. C. Clayton, for defendants.]

PATENT HARNESSES TRIMMING.—WILLIAM M. WELLING vs. THE RUBBER-COATED HARNESSES TRIMMING COMPANY, ANDREW ALBRIGHT, AND L. C. VOORHEIS.

[In equity.—Before Nixon, J.—Decided February, 1875.]

NIXON, J.: This is an application for an attachment against the defendants for violating an injunction issued by this court, June 12, 1874, restraining them from making, using, or vending to others to be used, any harness or carriage trimmings containing the invention of the plaintiff, and secured to him by letters patent, to wit, "a ring manufactured as set forth substantially, with "a metal ring enveloped in composition, as and for the purpose specified."

The injunction followed the decree of the court, sustaining the validity of the complainant's patent, No. 57,941, for "an improvement in rings for martingales;" and the question now suggested is the scope of the said patent.

In the course of the accounting before the master, it was insisted by the defendants that the patent of complainant referred only to the use of certain compositions in the manufacture of rings for martingales, and hence that the decree compelled them to account only for the manufacture of rings; whereas the complainant claimed that all the articles used in harness and carriage trimmings which have been treated by the process described in his letters patent, such as terrets, buckles, and hooks, should be included by the master.

I have examined the bill, answer, proofs, arguments of counsel, and the opinion heretofore given in the case, and this examination has confirmed the strong impression in my mind, when this application was made, that the complainant is asking that a wider scope be allowed to the claims of his patent than has yet been distinctly given to it by the court.

I do not mean to be understood as saying that it will not admit of such scope and meaning; but that the question has not been presented, and that the patent has not been considered in reference to such construction.

All that the complainant is permitted to claim, under the decisions of the court as it stands, is a specific article of manufacture, to wit:

A metal ring, coated with any plastic composition capable of being compressed and solidified by the use and action of dies, whereby a ring is produced with an exterior surface more durable and more highly polished than has before been obtained by different processes of manufacture and at greater cost.

Such a construction, obviously, relates to the product. The complainant's patent is held to be good for the product resulting from a new combination of old instrumentalities. His claim on this application is understood to be for the process, and that the invention includes that as well as the product. Doubtless both may be covered by one patent, as was held by Judge Grier, in this court, in the case of Goodyear vs. The Rubber Co. (2 Wall, p. 856); but in such a case the description of the invention in the specification and claims should disclose that the inventor had both results in his mind.

But the grave doubt here is whether the specification and claim of the complainant's patent are broad and full enough to cover a new process as well as a new product.

It is a well settled principle that a patentee may so limit his claim as to deprive himself of the full benefit of his invention or discovery. It was to remedy such a difficulty or omission that the privilege of surrender and re-issue was granted in the patent laws. Patentees often fail to realize any substantial advantage from some of the most useful inventions, owing to their too narrow claims, until such surrender, amendments, and re-issue have been made.

The complainant is entitled to be protected only in the rights which the letters patent cover and secure to him. I incline to the opinion that the specification and claim of the patent under consideration will be found too limited in their scope to admit of the construction now claimed for them by the able counsel for the complainant; but without expressing any decided conviction on the subject, I shall, at this stage of the case, deny the application for an attachment, and direct the master to proceed with the accounting.

Under the reference already ordered he may take an account—1. Of the rings coated and finished by the defendants, according to their methods as described in the proofs.

2. Of the terrets, buckles, and hooks, as claimed by the complainant. He will make up the two accounts separately, so that the aggregate of each may be readily distinguished; and when his report is made, the parties will have the opportunity of obtaining the judgment of the court in the matter, and as yet unconsidered, construction of the specification and claim of the patent, after their views are more fully presented, as they may be, on exception to the report.

[F. H. Betts, for complainant.]

J. C. Clayton and A. Q. Keesbey, for defendants.]

NEW BOOKS AND PUBLICATIONS.

THE PHILADELPHIA LEDGER ALMANAC. G. W. Childs, Philadelphia, Pa.

At the commencement of the year 1870, Mr. Childs, publisher of the daily *Philadelphia Ledger*, issued an almanac which contained not only the calendar and a great deal of statistical information of a local interest, but also several pages of practical household recipes, and other information of general value. One hundred thousand copies were printed and presented to the subscribers of the *Ledger* in that year. The first issue proving so acceptable as a book of reference, Mr. Childs was induced to continue the publication and gratuitous distribution among the *Ledger's* patrons, and each successive year has the work improved. By the favor of the publisher, we have before us, neatly bound, six years' numbers of his almanac, which make a handsome volume of 300 pages of very valuable information, on both local and general subjects, not attainable in so complete a form in any other work.

LEFFEL'S MILLING AND MECHANICAL NEWS. Fifty cents per annum. James Leffel & Co., Springfield, Ohio.

To persons interested in milling machinery or water power, this paper issued each month, possesses especial interest. The editor is an admirer of the *SCIENTIFIC AMERICAN*, and in his April number promulgates the fact as follows: "It is a matter of just congratulation to Americans that, whatever may be the assumed superiority of European standards in art and literature, this country has at least one scientific journal which so signally eclipses any foreign publication of the kind that a comparison can scarcely be made. We refer, of course, to the *SCIENTIFIC AMERICAN*, published by Messrs. Munn & Co. 37 Park Row, New York city. Besides being a recognized authority and inexhaustible medium of information in the whole domain of practical science, it is faultless in its appearance, and its illustrations are works of art. Its subscription price is \$3.50 per annum, postage prepaid, and the immense circulation it has reached is a proof of the advanced intelligence of the American people."

ORNAMENTAL DESIGNS FOR FRET WORK, FANCY CARVING, AND HOME DECORATIONS. Price 60 cents. New York city: Henry T. Williams, 40 Beekman street.

This book contains a very varied and extensive assortment of original designs, and will be found useful by the numerous workers with the band or jig saw. Our correspondence shows that many of our readers devote their spare hours to this occupation, which is a pleasing manner of passing the time, and occasionally a source of profit, as well as a means of adding to the interior decoration of a home. To their attention, we commend the numerous patterns given in this volume.

THE FIRESIDE ASTRONOMER, a Plain and Familiar Description of All the Most Important Facts relating to the Heavenly Bodies. By S. N. Manning, A.M. Kankakee, Ill.: Times Office.

This unpretending little pamphlet deserves to be widely circulated, for it contains a very clear and succinct explanation of the general plan of the sidereal universe and of the science of astronomy by which its laws have been defined. Free from algebraic and trigonometrical formulae, it is written throughout in a simple and clear style, which lacks nothing in precision or accuracy. We cannot expect that our tyros in the sublime science will find a book better suited to their needs.

PAPERS ON THE TAILS OF COMETS, AND ON THE LOSS OF LIGHT IN ITS TRANSMISSION THROUGH SPACE. By Henry M. Parkhurst, New York city.

This is a reprint of a very interesting paper read by the author at the Hartford meeting of the American Association for the Advancement of Science, in August last.

NOTES ON EXPLOSIVES. By Walter N. Hill, S.B., Chemist, U. S. Torpedo Station, Newport, R. I.

This pamphlet is a useful and compendious account of the constitution, action, and effects of the various explosives now in use in engineering operations and in warfare. The information in it has never, we believe, been collated before, and it is likely to be valuable to several important interests.

LECTURE ON THE WHITEHEAD TORPEDO. By Lieut. F. M. Barber, U. S. N., Torpedo Station, Newport, R. I.

A readable account, historical and descriptive, of an engine of destruction which now occupies the attention of naval men, as likely to play a most important part in future warfare.

A PRACTICAL TREATISE ON FRICTION OF AIR IN MINES. By the late J. J. Atkinson, Government Inspector of Mines for the County of Durham, England. Price 50 cents. New York city: D. Van Nostrand, 23 Murray and 27 Warren streets.

This little book throws much light on a subject little noticed in popular treatises on mining engineering; and it deserves to be attentively read, for it shows how readily the whole system of ventilation of a mine may be disturbed, and its efficiency destroyed, by the very currents intended to ensure a supply of pure air and free exit for foul gases.

INTEROCEANIC CANAL (Route of Pava). By L. Lacharme.

The author of this work desires to call public attention to the Pass of Pava as a route for the much discussed ship canal between the Atlantic and Pacific Oceans. He states that the Pass has always been followed by the Indians crossing the Isthmus, and claims, with apparent reason, that, by following it, a canal can be quickly and cheaply executed.

THE DENTAL SCIENCE AND QUARTERLY ART JOURNAL. Conducted by Dr. A. P. Merrill. Volume I, No. 1. One Dollar a year. New York city: E. Richards & Co.

This new-comer appears to be well and carefully edited, and is altogether a promising magazine for the use of the dental profession.

JOURNEY IN HONDURAS AND JOTTINGS BY THE WAY. By R. G. Huston, C.E., Honduras and Inter-oceanic Railway. Price 50 cents. Cincinnati, Ohio: Robert Clarke & Co.

A pleasant account of a country which attracts a great deal of attention just now, but the physical features of which are little known.

THE GRAHAMITE ASPHALT PAVEMENT ON FIFTH AVENUE, NEW YORK CITY. New York city: Francis and Loutrel, 45 Maiden Lane.

Mr. J. L. Graham invites public attention to this pamphlet, in which the facts as to the durability and excellence of his system and material for paving are duly set forth and verified by testimonials.

ANNUAL REPORT OF THE CHIEF ENGINEER OF THE WATER DEPARTMENT OF PHILADELPHIA, PA., FOR 1874.

CATALOGUE OF THE OFFICERS AND STUDENTS OF THE SCHOOL OF MINES, COLUMBIA COLLEGE, NEW YORK CITY, FOR 1874-1875.

SCRIBNER'S MONTHLY for May contains the first illustrated and complete description of the new opera house in Paris which we have seen published on this side of the Atlantic. There is, besides, an electro-mechanical romance, which tells how two lovers, one a railroad engineer and the other a telegraph operator, utilized an abandoned wire to make a circuit which the passing locomotive closed, and so rang a bell in the operator's office, thus warning her of the approach of her John's engine. This neat little contrivance, while a special train full of railway magnets is standing at the depot gives unexpected warning of the coming of a lightning express. The young lady rushes frantically up the line just in time to stop the approaching train and arrest a horrible accident—and of course, in the sequel, she and her intended are beautifully rewarded. It is a pretty little story, charmingly told, and, besides, conveys a possible hint for an invention. The rest of the papers are of the usual standard of excellence, and the illustrations plentiful and good. Jules Verne's "Mysterious Island" is continued, and there is a valuable illustrated article on "Drainage in Holland." Scribner & Co., Publishers, 735 Broadway, New York. \$4 a year.

THE ECLECTIC MAGAZINE for May offers a well varied and excellent table of contents, selected from the foremost of contemporary periodicals. Professor Huxley's "Results of the Challenger Expedition" is given in full. The Professor arrives at the conclusion that "all the chief known constituents of the crust of the earth may have formed living bodies; that they may be the ash of protoplasm, and consequently that the time during which life has been active on the globe may be indefinitely greater than the period, the commencement of which is marked by the oldest known rocks, whether fossiliferous or unfossiliferous." This paper will repay careful perusal, as will indeed the other scientific essays, notably the "Limits of Science," and the "Reproduction of Organisms," with which the present number is rich. Thomas Carlyle's "Early Kings of Norway," and Julian Hawthorne's "Stone and Plaster" are continued; and there are the usual serial and other stories and editorial summaries. E. B. Peltou, Publisher, 108 Fulton street, New York city. \$5 per year.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From March 30 to April 15, 1875, inclusive.

BOOTS AND SHOES.—L. Heath, Boston, Mass.
BRICK KILN, ETC.—E. W. Bingham, Portland, Oregon.
CAN DRAW AND BUFFER.—A. B. Pullman (of Chicago, Ill.), London, Eng.
CUTLERY, ETC.—O. W. Tait, New York city.
DEBILITATING INDICATOR.—J. Turner (of Chicago, Ill.), London, England.
FRICTION MATCH MACHINERY.—McC. Young, Frederick, Md.
GRADUATED BULE, ETC.—Hastings & Co., Granby, Conn.
LOOK.—J. F. Wicks, Providence, R. I.
LOOM PATTERN CHAIN.—J. F. Wicks, do.
MAKING SUGAR.—F. O. Matthiessen, New York city.
NET MACHINERY.—W. Charles, Chertsey, Pa., do.
PAPER BOX.—L. A. Kettle, Philadelphia, Pa.
RAILWAY WHEEL.—H. N. Allen (of Hudson, N. Y.), London, England, et al.
RECORDING STEAM GAGE.—M. B. Edson, New York city.
SPRINGER.—S. W. Fisk, New York city.
TRAMWAY, ETC.—A. S. Hallide (of San Francisco, Cal.), London, England.

Recent American and Foreign Patents.

Improved Ore Separator.

Thomas B. McConaughy, Newark, Del.—In using the machine, water is admitted at the upper forward end of a wash trough, and the ore is fed in at its lower rear end. The ore is moved through the channels of the trough against the stream of water by shovels, and is pushed by said shovels from the forward end of the said trough. The ore falls upon the screen, and the fine ore passes through the holes. The coarser ore and the rubbish are carried across the screen by its motion, and fall upon the apron of the carrier. The coarser stones and rubbish are removed by hand from the carrier apron as the stream of ore is being carried forward, and the remainder falls from the carrier into a receiver.

Improved Loom Shuttle.

James M. Peckham, Fall River, Mass.—This improvement consists in a metallic holder for the tension cloth and grooves cut in the shuttle from the shuttle opening to the eye recess. These grooves allow the holder containing the tension cloth to be shoved in to hold the tension cloth in the proper position. The holder is made of a single piece of sheet metal having two tongues doubled over on the plate. The cloth is slipped in between the plate and the tongues. The holder is slipped into the grooves, and the thread is passed over the cloth, which affords the necessary tension.

Improved Laboratory Gas Burner.

Charles D. Cheney, Canandaigua, N. Y.—The base is of concavo-convex form, having a hollow center extending down below its lower side. A small tapering tube receives the gas from the gas pipe, and delivers it in a small jet into the center of the burner tube, entering through an aperture in the hanging center. It is provided with a dovetailed lug, which fits a corresponding notch, the form of the notch being such as not to prevent sliding the tube endwise sufficiently to release the lug. A valve is made to close over the end of the center by means of the rod to which the valve is attached, which rod extends up through the base, with the lever on its upper end. This lever is moved back and forth between stops, and the extent or size of the flame is regulated thereby.

Improved Oiler.

Isaac Levy, Ellenville, Pa.—This oiler is so constructed that it may be first used for blowing off the dust, shavings, etc., from the places where the oil is to be applied, and afterward may be used for applying the oil. It is made in two parts—one made of sheet metal, for the oil, and the other made of india rubber, for the air—said parts being separated by a division plate, and each part being provided with its own nozzle.

Improved Bench Plane.

John E. Norwood, Boston, Mass.—The stock is provided with side openings, through which the cutting iron, which is made with side extensions, is permitted to pass out flush with the outside. The cutting iron is rigidly fastened and adjusted, and allows of the use of the plane for cutting rabbets, or as a block plane, for truing up miter joints or cutting across the ends of the wood.

Improved Comb.

Elias Brown, Wappinger's Falls, N. Y.—This is a neat and convenient comb for holding the ringlets or curls at the back of the head and preventing their falling forward; and it consists of two symmetrically arranged combs with curved connecting arms, which are pivoted together, to be introduced sidewise into the hair.

Improved Clothes Wringer.

Israel F. Brown, New London, Conn.—This invention consists of a shaft with anti-friction rollers interposed between the journals of the squeezing rollers and their bearings, so that the journals turn upon the faces of the rollers, while their shafts turn on the bearings, so as to diminish in large measure the resistance due to the great pressure of the journals on the boxes, and thus enable the machine to be turned much easier than the wringers usually are.

Improved Vulcanizing Apparatus.

William J. Birdsall, Naugatuck, Conn.—The rubber goods are vulcanized in a steam-heated chamber, and are thus rendered soft and silky to the touch, and superior to those vulcanized in dry heated air.

Improved Platen for Lever Presses.

John F. Taylor, Charleston, S. C.—This invention rests in the construction of a compound platen for a progressive lever or toggle joint cotton press, and it consists of a stationary part and a movable part, one part having cylinders and water ways, and the other part having rams or pistons and a suitable packing. It also consists in the method of regulating the space between the two parts of the platen by forcing water in, and letting the same out from between the stationary and movable portions of the said platen.

Improved Steam-Encased Engine Cylinder.

James E. Taylor, Westminster, Md.—This invention relates to certain improvements in steam-encased engine cylinders, and it consists in the peculiar construction of the steam dome in combination with the steam-encased cylinder, whereby the latter is relieved from the direct pressure of the entire subjacent body of steam, the tendency to become strained and loosened from the dome obviated, and the consequent leakage of steam prevented.

Improved Self-Raising Seat for Water Closets.

James E. Walter, Baltimore, Md.—This invention relates to certain improvements in seats for water closets, whereby the same are rendered self-raising. It consists in two hinges having a common pin, upon which, between the hinges, two parts of a spiral spring are wound in opposite directions from the middle, the central portions of the spring being secured to the frame work of the basin or closet, and the two extreme ends of the spring being inserted in holes in the edges of the seat to elevate the same. It consists also in the combination with the said spring and hinge of a cylindrical protective casing of sheet metal.

Improved Railway Safety Switch.

Edward A. Trapp, Davenport, Iowa.—This invention relates to certain improvements in railway safety switches, and it consists in a main rail having its bottom flange cut, flared inwardly, and bent up to form a horizontal guide, in combination with leading tongues, a volute spring, and a spring rail having its bottom flange extended so as to move under the guide formed by the cut portion of the main rail. By means of the peculiar construction of the switch, guard rails are dispensed with, the switch made self-adjusting in one direction, and a continuous line of rails always insured to and from the switch.

Improved Cooler for Lard, etc.

Frank C. Pray, New York city.—The essential features of this invention consist in devices whereby the lard is bleached, after having been cooled, by being separated through the perforations of bottom sieve and caused to drop in small globules through the air. The invention is also intended for cooling milk and any oleaginous matter, and may be seen in operation at the store of the inventor, 83 West 12th street, as above.

Improved Piston Packing.

James L. Sherman, Cassville, Wis.—This invention consists in the construction and arrangement of divided and grooved rings to form the packing of a steam piston rod, and a cup-like device for containing said rings and receiving the steam, which acts on and compresses them upon the rod.

Improved Pen Holder.

John Boyd, New York city.—This is a flexible connection of the pen to the holder, made by connecting the tube of the penholder to the handle by a rubber band at the upper end, and a spring below, so that the point of oscillation is at the upper end of the tube. This is said to give better results than when the pen is connected to the lower end of the tube by a spring, so that the axis of motion is at the lower end. A further improvement on the penholder in common use is effected by placing an eccentric spring tip on the spring, which fills the hollow tube of the penholder. The pen is placed between the tip and the tube, at the smaller diameter of the latter, and bound in its place by turning the tip.

Improved Twine Holder.

Jonathan Hill, Stanhope, N. J.—The twine box contains the ball, from which the twine is passed along a hollow axle, out through the side, around a drum, thence to the guide eye in the ceiling, from which it is to be suspended over the counter. It passes also through the guide eye of a trip lever, so that when it is pulled off the ball the tension will lift the lever, and, by swinging the axle support, shift the drum out of gear with the regulating device, which is intended to not when the recoil takes place to slow the motion of the spring. When the twine is pulled off from the drum, it will wind up the spring, to turn the drum back to wind on the slack again.

Improved Machine for Crushing Oleaginous Seeds.

Alfred B. Lawther, Chicago, Ill.—This machine has crushing rollers of great power, to which the seed is fed, under certain pressure, by an upright supply pipe, of suitable height, having a fluted feeding roller and hopper at the top end. The oil seeds are forced through the feed pipe, and compelled to pass through the rollers, which, by the uniformity and power of their motion, crush the seeds and break the oil cells completely, without reducing any portion to paste condition, leaving also the husks or bran comparatively coarse, so that it may be seen in the cake after pressing. The crushed seeds are then passed to the mixing and moistening machine, doing entirely away with the muller stones, and producing a greater yield of oil with less power, less labor, and less pressure on the oil-extracting presses.

Improved Chuck for Making Swelled Tenons.

Alexander D. Huff, Owingsville, Ky.—This invention consists of a pin and a lever, combined with a sliding tool in a revolving chuck, in such manner that the end of the piece on which the tenon is to be formed forces the tool, having an irregular edge for making swelled tenons, down against the side to dress off the tenon, by pushing the pin backward as the piece enters the cavity of the chuck. The invention also consists of a spring, combined with the sliding tool, the lever, and the pin, so as to push the tool back out of the way of the swelled portion of the tenon when it begins to withdraw from the cavity of the chuck, and allow it to pass out without the swell being cut off.

Improved Ventilating Attachment to Hearths.

William S. Winfield, Cross Plains, Tenn.—This invention consists of a box-shaped attachment, with hinged and concaved lid and cinder basket, set into the floor below the grate, to communicate either with the story below, or by a pipe with the outside air, for supplying the required ventilation on the opening of the lid for the ready kindling of the fire, etc.

Improved Tongue Support for Vehicles.

James McCarter, Frankfort, Ind.—This is an improved spring support for wagon tongues, by which the jerky action of the tongue and the strain on the horses arising therefrom on the passage of the vehicle over rough and uneven ground may be to considerable extent avoided. The invention consists of a U-shaped piece of spring wire, which carries, at the front part, a tongue-supporting pulley, being bent spirally around side pulleys of the pivot bolt, connecting tongue, and bounds, and applied with the rear ends equidistant from the king bolt to the front axle.

Compound Switch for Fire Alarm Telegraphs.

Samuel Weeks, New Orleans, La.—This is a compound switch for fire alarm telegraphs, for throwing by one movement a series of switches into circuit. It is composed of a series of upper switch fingers, establishing and breaking circuit of main alarm battery, and of a set of lower spring fingers for closing and opening the local batteries, in combination with an intermediate insulated crank shaft, and with opposite non-conducting cam extensions. The whole is so arranged that a turn of the crank shaft causes simultaneously the contact of the upper fingers and the disconnecting of the lower, or the breaking of contact of the upper and the closing of the lower.

Improved Screw-Cutting Die Plate.

Horace Grilling, New Haven, Conn.—This consists of two separate dies fitted in a recess in the side of the plate by being boxed thereto and bolted fast, so that they can be readily taken off, by removing the bolts, for changing and sharpening. The dies are provided with slotted holes for the passage of the bolts by which they are fastened to the plate, to allow them to be adjusted to suit the size of the pipe to be cut. The screws for adjusting the dies are fitted in hollow handles, which are also jointed near the plate, and the detachable portions have a socket in the end to receive the projecting shank of the screw when screwing into the portion formed on the plate.

Improved Miter Box.

Theodore C. Lawrence, Ladoga, Ind.—This invention consists of a metallic recessed guide casing, in which the saw runs by means of detachable clamped extension strips, a central wooden strip preventing the getting dull of the teeth. Wing-shaped side plates of the casing bear pivoted clamp plates, which may be set to any angle on the supporting wing plates. The clamp plates are provided with sliding and guided strips for fastening the molding securely by strong clamping screws, to expose it to the saw or connect the corners. The solid metallic construction of the miter box produces the permanent and accurate working of the same without the inaccuracies of the variable wooden boxes.

Improved Steam Brake.

Thomas F. Fouts and Elijah Planck, Burlington, Iowa.—This is a steam cylinder and piston, arranged transversely of the locomotive, and geared by a toothed rack attached to the piston rod with a revolving line shaft, which extends along the train from car to car, and winds up the chains which work the brakes. The steam is supplied from the locomotive boiler, with which the engine is connected by a pipe, to admit steam at one end for applying the brake. Springs are used to force the piston back. The line shaft is in sections, one for each car, which are coupled by socket couplings, which slide forward and backward as the train slackens and extends.

Improved Machine for Coiling Metal Rods.

Philander H. Standish, Jefferson City, Mo.—The mandrel consists of a plain flat bar of steel, wide and thick as the largest coil to be bent, with an oval tapered point, graduated from the size of the largest to that of the smallest coil to be made. The bar is fitted in the hollow shaft of the driving wheel, so as to be shifted along it, to cause the tapered point to project under the bending wheel more or less, according to the size of the coils to be made. A collar at each end of the hollow shaft holds it wherever it may be set, to utilize the same machine for coils of all sizes.

Business and Personal.

The Charge for Insertion under this head is \$1 a Line.

For Sale—Large lot second hand Machinists' Tools, cheap. Send for list. I. H. Shearman, 45 Cortlandt Street, New York.

Agricultural Implements, Farm Machinery, Seeds, Fertilizers. R. H. Allen & Co., 189 & 191 Water St., N. Y. Magic Lanterns, Stereopticons of all sizes and prices, for Parlor Entertainment and Public Exhibitions. Pays well on small investment. Catalogues free. McAlister, Man'g. Optician, 49 Nassau St., N. Y.

Fleetwood Scroll Saw, with Boring Attachment, for all descriptions of light scroll sawing. See adv't. page 285. Trump Bros., Manufacturers, Wilmington, Del. For Sale, Cheap—One half interest in Gate and Door Bolt, patented Dec. 2, 1873, for \$800. Address Josiah Smith, Southold, L. I.

Treatise on the Steam Engine Indicator, price \$1. Address E. Lyman, C. E., New Haven, Conn.

\$5,000 invested in an important invention will find great profit. A. D., 353 Morris Av., Newark, N. J.

Lathe Gear Cutters, Wm. P. Hopkins, Lawrence, Ms.

Harness and Belting Leather Stripping Machine, not power; does work of 4 men; for sale, or partner wanted for patent. A. Barré, N. Orleans (335 Bourbon).

Wanted—A responsible party to manufacture my improved Violin, on royalty or otherwise. Address Dr. J. H. Payne, Garner, Miss.

Wanted—Address of Korting's Condenser. Box 92, Kingston, Pa.

Our Bolt Cutters and Lightning Screw Plates are the most perfect labor-saving tools of the kind in the world. Wiley & Russell M'g Co., Greenfield, Mass.

During fourteen years' experience with advertisers and advertising agencies, we have never had dealings with a firm whose straightforward, upright policy so largely secured our confidence and respect as that of Geo. P. Rowell & Co., Advertising Agents, New York. Their contracts are always plain, intelligible and specific. They secure the most advantageous rates from publishers for the reason that the latter feel assured that they are secured beyond chance or technicality, in getting whatever the amount of their contract calls for, providing always that publishers have done as they agreed to.—[St. Louis City (Iowa) Times.]

Assistance wanted to obtain Patents in Canada and Europe, for an Ironing Machine; one half interest will be assigned. Geo. F. Perreault, Rockport, Texas.

The "Catechism of the Locomotive," a book of 625 pages, 250 engravings, fully describes the theory, construction, and management of American Locomotives. Price, post-paid, \$2.50. Address The Railroad Gazette, 75 Broadway, New York.

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

Wanted—Machinery for splitting out or riving Pipe Staves 60 inches long, 3 to 5 inches wide, and 1 1/2 inch thick, from White Oak Timber, for the New Orleans market. Address Geo. G. Hughes, Jackson, Tenn.

One Barrel Stave Saw and Edger, nearly new, for Sale Cheap, by S. J. Benedict, East Randolph, N. Y.

"Book-Keeping Simplified." The Double-entry System stripped of all complication and difficulty. Complete practical instruction in a few pages. Price, cloth, \$1. Boards, 75 cts. Sent post paid. Catalogue of Practical Books free. D. B. Waggener & Co., Publishers, 24 Walnut St., Philadelphia.

A complete bed-room earth closet for \$5. Send or pamphlet. Sanitarian M'g Co., 41 Courtlandt St., N. Y.

Mills for Flour & Feed, White Lead, Colors, Ivory Black, Printing Ink, &c. John Ross, Williamsburgh, N. Y.

Telegraph and Electrical Instruments and Batteries, cheap. M. A. Buell, 86 Bank St., Cleveland, O.

Models for Inventors.—H. B. Morris, Ithaca, N. Y.

Three Second Hand Norris Locomotives, 16 tons each; 4 ft. 8 1/2 inches gauge, for sale by N. O. & C. B. H. Co., New Orleans, La.

1, 2 & 3 H.P. Engines. Geo. F. Shedd, Waltham, Ms.

See N. F. Burnham's Turbine Water Wheel advertisement, next week, on page 333.

2nd Hand Engines and Boilers for Sale at Low Prices. Address Junius Harris, Titusville, Pa.

Millstone Dressing Diamond Machines—Simple, effective, economical and durable, giving universal satisfaction. J. Dickinson, 64 Nassau St., New York.

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

The "Lehigh" Emery Wheel. A new patent. Address Lehigh Valley Emery Wheel Co., Weissport, Pa.

Small Property, well located for economical manufacturing. Lump coal costs \$2, and Nut coal \$1.50 per ton, delivered. Taxation 1.37. Employees' houses rent for \$5 to \$12 per month. Excellent shipping facilities. Buildings new and in good repair. Good schools, churches, and desirable community for residence. Full description, price and terms, by addressing Kiltredge Cornice and Ornament Company, Salem, Ohio.

Thomas's Fluid Tannate of Soda never fails to remove scale from any steam boiler; it removes the scale-producing material from all kinds of water; cannot injure a boiler, as it has no effect on iron; saves 20 times its cost both in fuel and repairs of boiler; increases steaming capacity of boiler; has been tested in hundreds of boilers; has removed Bushels of Scales in single cases. It is in Barrels 500 lb., 1/4 Bbls. 250 lb., 1/2 Bbls. 125 lb. Price 10 cents per lb., less than 1/4 price of other preparations, and superior to all others. Address orders to N. Spencer Thomas, Elmira, N. Y.

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Faught's Patent Round Braided Belting—The Best thing out—Manufactured only by C. W. Army, 301 & 303 Cherry St., Philadelphia, Pa. Send for Circular.

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

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.

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Tempies and Olicans. Draper, Hopedale, Mass.

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

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.

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

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Spinning Rings of a Superior Quality—Whitinsville Spinning Ring Co., Whitinsville, Mass.

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Wash Stands, New Styles, Marble Tops, can be used in any situation. Prices very low. Send for a catalogue. Bailey, Farrell & Co., Pittsburgh, Pa.

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

Mechanical Expert in Patent Cases. T. D. Stetson, 23 Murray St., New York.

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

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

Notes & Queries

A. A. can separate aluminum by the process described on pp. 99, 116, vol. 32.—T. H. Y. can make garden walks by the method described on p. 50, vol. 32.—E. L. S. can silver plate his iron knobs by using the preparation described on p. 187, vol. 30. It would be better to copper them first, see p. 90, vol. 31.—M. J. G. will find directions for bronzing on iron on p. 283, vol. 31, and on brass on the same page.—J. D. C. can raise water by the device described on p. 259, vol. 31.—H. E. L. will find a recipe for a dip for gilding brass on p. 332, vol. 30.—H. D. G. can solder iron to iron by the method described on p. 123, vol. 30.—E. B. can construct a continuous battery by following the directions on pp. 315, 362, vol. 31.—E. C. B., H. M., and others can cement brass lamp fittings to glass by using the preparation described on p. 27, vol. 30.—M. A. G. can make condensed milk by the method described on p. 343, vol. 30.—F. E. W. can remove mildew from cotton cloth by washing with soap. A recipe for acid dip for castings is given on p. 107, vol. 31.

(1) C. J. M. asks: In burglar alarms, how is the gas lighted when an alarm is given? A. By a friction match, in many kinds of alarms.

(2) C. H. A. asks: 1. What is the meaning of the word ohm, in electrical science? A. A unit of resistance. 2. I am making the positive element of a Smee's battery (the silver plate) by depositing the silver on tin foil. How can I get the foil off the plate? I cannot remove it successfully by melting. What acid will dissolve it without affecting the silver? A. Cover the foil with plumbago before depositing the silver. 3. I have made several Leyden jars lately, but they do not work properly. The foil was attached to the inside and the outside of the jars with ordinary flour paste. The machine (plate 16 inches, 4 rubbers) works admirably, giving a spark of from 3 to 4 inches, but I cannot accumulate a particle of electricity on the jars. A. Connect all the outer coatings together for one side and all the inner coatings for the other. 4. How can I manage to deposit a film of silver on polished copper, so that it can be removed without solution of continuity? A. Cover with plumbago.

I have a coarse-grained grindstone which, with considerable labor, I had fitted to my lathe. Owing to the swelling of some wooden wedges near the center, the stone split into two pieces. What cement can I use to repair the damage? A. Try a mixture of black japan varnish and white lead.

(3) J. B. C. asks: How are steel magnets, to retain a large quantity of magnetism, made? What kind of steel is used, and how is it tempered? A. Steel magnets designed to possess strong magnetic power should be made in sections and fastened together. In order to retain their power the poles should be connected together by an iron keeper.

(4) W. E. D. asks: 1. Is the Smee battery a good and desirable one for running a short telegraph line? A. Yes. 2. What is the best solution to use with the above battery, the zinc plates being amalgamated? A. 1 part sulphuric acid to 20 water. 3. How often would a battery of 5 one quart jars of the Smee pattern require cleaning and fresh solutions, in running a line one mile long in close circuit? A. If you use magnets of 200 ohms resistance, probably the battery would run six months. 4. Would the above battery be sufficiently strong for nickel plating? A. Yes. 5. We have a telegraph line nearly one mile in length, with eight offices; would it not be best to have all the batteries of the line divided and half of them placed at each end rather than have three or four at each office on the line, it being a close circuit? A. It makes no difference where you put the batteries in the line. 6. I had occasion to repair a small sander; and on taking off the paper covering of one of the spools, I found the spool was wound with No. 25 wire, not insulated; but between each layer of the wire was a piece of paper to insulate the layers from each other. Please explain the *modus operandi* of this. A. The wire is wound in such a manner as to keep the different turns from touching. Many regard this method as better than insulating the wires with silk or cotton.

(5) C. J. H. says: You give a recipe for making a blue black ink which calls for sulphate of indigo in the form of a thinish paste, and which should be neutral, or nearly so. Please

give me the formula for making this ingredient for this purpose. I have made the sulphate of indigo as follows: 8 ozs. sulphuric acid (commercial), and 1 oz. indigo in powder, carefully mixed. With what shall I neutralize the acid? I have tried carbonate potassa, powdered chalk, and marble dust; either will neutralize the acid, but on filtering out (after mixing with water) the chalk or marble dust preparations, the coloring matter combines with the lime, and the liquor passes off clear, leaving the coloring matter in the filter. If I use the carbonate of potassa to neutralize the sulphuric acid, the soluble sulphate of potassa goes into the ink; and in using a steel pen, the sulphate attacks the pen and leaves an annoying crust upon it. Can you help me out of my difficulty? A. Add small quantities of indigo until the solution is neutral, or nearly so.

(6) W. B. H. says: I wish to bring a stream of water from a reservoir, in 3 inch pipe, down a hill, and across a wide ravine, and up an inclined plane on the other side. The fall from the reservoir to the bottom of the ravine is 150 feet, and from the bottom of the ravine, up the hill on the other side, to the discharge is 50 feet rise. 1. What would be the pressure to the square inch at the bottom of the ravine? A. About 65 lbs. when the flow of water is stopped at the outlet, and 22 lbs., plus the friction, or say 25 lbs., when the water has free discharge. 2. Would the pressure be greater in consequence of the rise of the pipe on the other side? A. Yes, when running free; no, when stopped. 3. Would material that would make a pipe one inch in diameter, that would sustain a pressure of 150 feet fall, make a three inch pipe that would sustain the same pressure, or must the strength of the pipe be increased in the proportion that the size is increased, to enable it to sustain the pressure of the same fall? A. No; the strength must be increased in proportion to the diameter of the pipe. 4. How high would it throw water from a common hydrant through an ordinary hose pipe? A. From 40 to 75 feet, according to the material of which the pipe is made and the number and abruptness of the bends in it. 5. Would 50 feet rise on the one side be exactly equalled by 50 feet fall on the other, leaving, at the discharge, the full force of the remaining 100 feet fall, or would the force of the remaining 100 feet fall be made less by the effect of 50 feet rise? If so, how much? A. The force would be less in consequence of the friction in the extra length of pipe. How much less will depend upon the velocity of discharge, the material of the pipe, and the care with which it is laid.

(7) T. H. R. asks: Has electricity ever been used as a motive power for running light machinery, such as printing presses, sewing machines, etc.? A. Not with any practical success.

(8) B. J. A. says: I have seen attached to the guards in front of show cases a class of electric machines for giving shocks, constructed in the following manner: The guard (generally of wood) is covered with metal or some other conductor, and, as far as I could see, one pole of a cell of battery was connected with one end of the guard, and the other pole with the other end. A person putting both hands on the metal would instantly receive a shock. I have constructed one on the above principle, and it will not work. Can you inform me where the trouble lies? A. The circuit must be so arranged that the current shall pass through the person.

How much nitrate of silver can be made from one ounce of pure silver? A. One ounce of nitric acid will dissolve one ounce of silver.

(9) W. L. R. asks: What size of insulated wire is the best to make electro-magnets for attracting weights? A. No. 16. 2. Will cotton-covered answer as well as silk-covered? A. Yes.

(10) A. B. asks: 1. How shall I proceed to set up a Callaud battery? A. To set up the battery, place the coppers in the bottom of the jars, fill with blue vitriol to a level with the tops of the copper; suspend the zincs in position so that the bottom of each shall be about two inches from the top of the copper. Connect the copper of each cell to the zinc of the next, fill the cells with pure soft water to cover the tops of the zincs; then put the battery on short circuit for twenty-four hours, or until the solution immediately under the zinc appears clear and white, when the battery will be ready for use. No acid or quick-silver is used. The zincs must not be amalgamated. After the battery has been in use a few days, the zincs may be lowered half an inch to an inch, care being taken not to allow them to touch the blue solution. Lowering the zincs decreases the battery resistance, and is only necessary where a number of wires are worked from one battery. About two pounds of sulphate of copper per cup is required to charge the smaller cells, and four pounds the larger. A little oil poured upon the surface of the solution in the cells prevents evaporation and creeping over of the zinc solution on the edge of the jars. When oil is not used, it is better to charge the battery with a smaller quantity of blue vitriol, a little being added from time to time, as the supply is exhausted. 2. Please explain the meaning of the word ohm, as applied to telegraphy. A. The ohm is a unit of resistance. 3. I have a sander marked 6 ohms. Will this work on a metallic circuit of 1,700 feet with 3 cells of a Callaud (local) without a relay? A. Not very well. You will require about 10 cells. You will achieve success if you persevere. Reading by sound requires a great deal of practice.

(11) A. N. W. says: I am making an electrical alarm clock to be operated from the front door of the house. The circuit is about 60 or 70 feet, with No. 20 copper wire supported on wooden brackets, with one Callaud's cell. The magnet consists of 2 pieces of soft iron 1/4 inch diameter, 3 inches long, screwed into one piece (3/4 x 1/4 x 3/4 inches). I have about 1/4 lb. very fine insulated silk wire coiled on magnet; but it will not work. Can you tell me the reason? A. Use No. 20 wire

for magnets. Put armature within sixteenth of an inch of poles, and use ten cups of battery arranged in two series.

(12) G. asks: How many cubic feet of gas will one gallon of gasoline make at ordinary burning gas pressure? A. The quality of gasoline varies greatly; but 200 cubic feet would be a fair average.

(13) X. Y. Z. says: I have a block of building, 23 feet deep, with a roof of slate of 7 feet pitch. During the winter I have been extremely annoyed by the snow and ice crowding over the eaves. It seems as if the sun softened the snow and partially melted it, and saturated that in the gutter with water. At night it would freeze into ice, and again melt upon the roof next day. The snow would slide off, and crowd this gutter ice until it would project a foot or more over the eaves, and produce a very unpleasant drip, besides being absolutely dangerous in case of falling. What is the best and at the same time economical remedy? A. Take a plank 12 inches wide, set it up vertically about 6 inches back of the gutter, block it up about 3 inches, and brace it with iron braces from the top back to the roof; this will hold the snow and let the water run through. But the snow will cause some of the water to remain on the slate, to make its way through the joints thereof by capillary attraction. It will therefore be necessary for you to take off the lower corners of slate for about 4 feet in height, and relay this portion with tin only.

Can anything be put into white lead paint to prevent its turning yellow? A. Enough blue paint is sometimes put into white lead, at the time of mixing, to give it a slightly bluish cast, and to counteract its tendency to turn yellow.

(14) T. B. asks: 1. What is the best paint or other substance, to put on a smoke stack where the heat has heretofore burned off everything we have tried? A. Coal tar, commonly called black varnish. 2. Would tubes put into a boiler, parallel with the central flue, be likely to make it generate steam more quickly? A. Yes, if put in by a good boiler maker.

(15) C. M. A. asks: I propose to put in a cistern, the water of which is to be used for drinking purposes. What is the best kind of filter to use? It strikes me that a wall across the cistern, of porous brick, would be the cheapest. How would it answer? How thick should it be? A. Brick is frequently used for this purpose; the wall may be built across one side of the cistern, and, as the water will be always of nearly the same height on both sides of it, 4 inches thick will be sufficient. 2. If I put the cistern in my cellar, would any ill effects arise from dampness, etc., in the house? A. Not if properly covered in and ventilated from the outside.

(16) M. A. says: I have an underground cistern, walled with brick laid in cement, and plastered in the usual way. Rosendale cement being used. At about 18 inches from the bottom there is a leak, the water rising in the cistern to about the height of 1 foot. I have tried several plans, but have not succeeded in keeping the water out. In one instance I dug a hole, six inches in diameter, four feet below bottom of cistern, into which the water drained: into this I put a pump, and kept the water level below the bottom of the cistern. I now put another coat of cement on, keeping the water pumped out till the cement was well hardened, took out the pump, tamped the hole with clay to within 3 or 4 inches of top, and filled with cement; but it would not hold. The pressure of water broke the cement, which did not adhere to the old cement. What is the remedy? A. The best Portland cement is very much superior to the Rosendale for the purpose you refer to, but it should have a chance to set before it is immersed in the water. To do this, build the bottom and about 2 feet in height of the sides of the cistern above ground; supply it with as much water as it will absorb easily in setting; let it stand until it gets as hard as stone; then lower it into the excavation and build the remainder of the cistern upon it. This bottom tub may be built of brick, well grouted in the cement, or with cement concrete, composed of broken stones, bricks, gravel, sand, and cement. The proportion of the ingredients may be as follows: 1 measure of cement powder, 3 measures of clean sharp sand, and 3 measures of broken stone and gravel. To resist pressure, the bottom may be built of a concave or arching form, like a dome reversed. The following is an instance of the capabilities of concrete to resist the action of water: At the harbor of Cherbourg, France, the blocks, of 12 feet by 9 feet by 6 1/2 feet, containing 712 cubic feet, and weighing 52 tons, were built up of mortar and stone, like rubble masonry, without molds. The mortar contained one measure of Portland cement powder to three of sand, and occupied from 1/4 to 1/2 of the entire mass. Blocks of this kind, 9 months old, showed a compressive strength of 113 tons per square foot, which is but little inferior to that of Portland stone. Their cohesive force was about 200 lbs. per square inch. After becoming hard, they were slung to pontoons and thrown loosely into the sea. Some of the 52 ton blocks have in heavy gales been thrown up from the bottom of the sea (30 feet deep) and lodged on top of the breakwater, entirely uninjured.

(17) W. M. asks: 1. Our steam gage indicates 12 lbs. steam even when the boiler is cold, and there is no steam at all. Will the gage show 12 lbs. more than the true pressure when the steam rises? A. Yes. 2. We are running a 6 inch circular saw at about 500 revolutions per minute. We have gummed the saw twice, and have taken off about 1/4 inch in the diameter of it; but since we gummed it the last time we have been troubled by the saw running toward the log. What is the remedy? A. The saw ought to be hammered. 3. The saw is not flat: the side toward the log is convex about 1/4 inch. Ought this to be so? A. No. It is the cause of the difficulty before mentioned.

(18) S. H. L. says: I have some very soft castings of iron; while cutting a thread on them, all the cuttings stand on end. What is the cause? A. Magnetism, created by friction produced by using a dull tool.

(19) W. H. G. asks: 1. What will be the effect of carefully retempering a good quality of steel, say a tap 1½ inches in diameter and 15 inches long, carefully repeating the tempering 5 times? Will the rise of thread be increased or decreased? A. No. 2. Will the cutting quality be affected? A. Yes, it will deteriorate.

(20) E. H. says: I am an engineer on a tug; her boiler is constructed in locomotive fashion, with 42 flues 2½ inches in diameter; firebox is 4x3 feet. The flues in the firebox end leak constantly. If I stop them and blow out, they stop leaking, but commence to leak again as soon as I have occasion to carry a hot fire. A. Probably the tubes are too close together, so that the circulation is imperfect. If so, more moderate firing and steaming will doubtless be the only remedy.

(21) O. G. B. asks: What is the best mode of constructing a firebox under a horizontal tubular boiler to burn slabs and sawdust? The boiler is 48 inches in diameter and 10 feet long, with 36 three inch tubes. What length and width of grate surface would be required? A. Make the furnace from ¾ to ¾ larger than for burning wood. See p. 59, vol. 3.

(22) J. C. C. asks: 1. What disadvantage is there in a small upright double cylinder engine with both cranks on one shaft? I do not hear of any such being made. A. There are many such engines in use, but ordinarily a single engine is considered simpler. 2. What power could I get from such an engine, the cylinders being 2 inches in diameter and of 4 inches stroke? A. Horse power—pressure on piston in lbs. per square inch × speed of piston in feet per minute ÷ 33,000. 3. What would be the best way to set the valves to get the most power? A. Cut off steam at about ¾ of the stroke. 4. In what relation to each other would it be best to set the cranks? A. At right angles. 5. Will brass wear as long for the cylinder and other working parts as iron? A. Yes. 6. Will the double cylinder engine give more power than one cylinder, of the same piston surface as both? A. No. How can I make a writing fluid that is green when first written with, but turns black on drying? A. Take 15 parts by weight bruised gall nuts, and 90 parts water. Boil for an hour, and then add 5 parts sulphate of iron, 4 parts iron borings, and 1 part indigo dissolved in 3 parts sulphuric acid.

(23) H. H. H. asks: What is the weight on the crosshead of a 10x20 inch engine, with connecting rod 60 inches long and pressure 50 lbs.? Please give the rule. A. The pressure of the steam in lbs. per square inch, multiplied by the area of the piston in square inches. To this must be added the weight of the moving parts, when they act so as to increase the strain.

(24) B. R. F. asks: What is the best means of cleaning a basement of roaches? A. Put 1 drachm phosphorus into a flask with 2 ozs. water, plunge the flask into hot water, and when the phosphorus has melted pour the contents of the flask into a mortar with 2 or 3 ozs. lard. Triturate briskly, adding water and ½ lb. flour, with an ounce or two brown sugar. This paste is said to effectually destroy roaches.

(25) H. J. M. says: I want to construct a small boiler for driving light machinery. Will tin plate stand a pressure of 15 lbs. per square inch, the boiler being 2 feet square by 6 inches deep? A. You can use tin if you make the boiler cylindrical, from 8 to 9 inches in diameter.

What are the yellow shining particles in the piece of stone enclosed? A. It is mica.

(26) M. A. J. asks: Will a wrought iron rod, after being heated a number of times from 70° to 212° Fah., cease to be affected as to contraction and expansion by the heat? A. Any material under these conditions will have its coefficient of expansion affected in time, and after long use may cease to be sensibly influenced by change of temperature. It is a general law that all machines, including animal mechanism, wear out in course of time.

(27) R. H. J. asks: How many gallons will flow per minute through a ¾ inch nozzle on a 3 inch hose, with 40 lbs. pressure per square inch? A. About 7 cubic feet. 2. How much will flow through a ¾ inch nozzle on a 2 inch hose with the same pressure? A. About 1½ cubic feet.

(28) D. C. C. asks: 1. I have been running an engine 22 by 24 inches stroke, with a 9 foot fly-wheel, making 120 turns per minute. How can I find out how many horse power this engine is? A. The only way to ascertain the power definitely is to make an experiment with a brake or dynamometer. 2. Can the steam make any difference in the power when it makes the same number of strokes per minute with 40 lbs. as with 80 lbs.? A. The steam is, no doubt, wire-drawn, if the engine does as well with 40 as with 80 lbs. of steam.

(29) C. R. asks: Can I burn a hole about 7 inches in diameter through a cast iron plate nearly 1 inch thick, by the use of the oxyhydrogen blowpipe? I cannot get at it to drill it. A. It could be done, but it would be very expensive. We think that if you can reach it with a blowpipe you can probably devise some arrangement to attack the material with a tool.

Will soluble glass do to coat a tin vessel with so as not to be corroded by sulphuric acid? A. Yes.

(30) H. B. B. asks: If the tensile strength of cast iron is 15,000 lbs. per square inch, how will a fly wheel rim of 1 square inch sectional area sustain 30,000 lbs.? A. If the 30,000 lbs. is tensile strain, and the tensile strength of the material is 15,000 lbs., of course the wheel would not resist it.

(31) H. W. G. asks: Why do kerosene lamps, especially those made of brass, sweat oil, or why does oil collect on the sides of lamps filled with kerosene? A. It is due to the evaporation of the oil drawn up through the wick by capillary attraction while the lamp is not in use, which is condensed in part upon the cold surfaces of the lamp. Try an airtight cap.

(32) H. R. E. asks: Can you give me a recipe for an ink for writing on zinc, that will stand the action of sulphuric acid? A. No. The sulphuric acid will dissolve the zinc at once.

(33) F. M. asks: Is there any way to temper machinists' tools, such as straight edges and squares, without warping them? A. Make them out of old saw blades, which require no tempering.

(34) F. B. S. asks: How can I make the eggs of Pharaoh's serpents? A. These are little cones of sulphocyanide of mercury which, when lighted, give forth a long, serpent-like, yellowish brown body. Prepare nitrate of mercury by dissolving red precipitate in strong nitric acid as long as it is taken up. Prepare also sulphocyanide of ammonium by mixing 1 volume sulphide of carbon, 4 strong solution of ammonia, and 4 alcohol. This mixture is to be frequently shaken. In the course of about two hours, the bisulphide will have been dissolved, forming a deep red solution. Boil this until the red color disappears and the solution becomes of a light yellow color. This is to be evaporated at about 80° Fah., until it crystallizes. Add little by little the sulphocyanide to the mercury solution. The sulphocyanide of mercury will precipitate; the supernatant liquid may be poured off, and the mass made into cones of about half an inch in height. The powder of the sulphocyanide is very irritating to the air passages, and the vapor from the burning cones should be avoided as much as possible. To ignite them set them on a plate or the like, and light them at the apex of the cone.

(35) W. S. H. asks: How can I temper a thin circular saw, about 2 inches in diameter and ½ thick, without springing it? A. Heat red hot, place between two flat perforated iron plates, and lower into oil, quenching right out.

(36) N. R. asks: How are wood screws cut? I have made a die that cuts the thread well enough, but I cannot form a point. A. This is done by a special patented machine.

(37) H. P. G. and others ask: 1. What is the nature of an explosion of gunpowder? Does it press equally in all directions? A. The effect of an explosion of gunpowder is simply due to the sudden conversion of the grains from the solid into the gaseous state. With gunpowder we have a volume of gas, which would normally occupy a space three hundred times as great as the grains occupied, liberated rapidly, but still in a perceptible interval, and for this very reason gunpowder is the safest projectile agent thus far discovered. For if, as in the case of nitro-glycerin, this large volume of gas were liberated all but instantaneously, the strain upon the gun would be so great that it would, in all probability, burst the breach before it started the ball. 2. Why does not the ramming, in blasting rocks, blow out before the rock splits, for it cannot possibly be made stronger than the rock? A. See answer to A. J. K., on this page.

(38) A. J. K. says: A sand blast is made by pouring dry sand upon the powder in a drill hole. When the powder is exploded, why is the loose sand not driven out, and the rock left uninjured? A. The pressure of the gas at the moment of its liberation is, of course, equal in every direction. It must also be borne in mind that before this volume of gas has expanded to the density of the atmosphere it must have displaced a column of air which exerts a pressure of something over a ton on every square foot of surface. With nitro-glycerin a volume of gas, 900 times that of the liquid used, is set free all but instantaneously. It can readily be seen that the sudden development of this large volume of gas, which becomes at once a part of the atmosphere, would be equivalent to a blow by the atmosphere against the rock; or, what would be a more accurate representation of the phenomenon, since the air is the larger mass, and acts as the anvil, a blow by the rock against the air.

(39) F. B. asks: Will an explosion of unconfined nitro-glycerin upon the surface of a rock split it? If so, why? A. Take a light wooden surface, say one square yard; the pressure of the air against the surface is equal to about 9 tons, but the air presses equally on both sides, and the molecules have such great mobility that, when we move the surface slowly, they readily give way, and we encounter but little resistance. If, however, we push it rapidly forward, the resistance greatly increases, for the molecules must have time to change their position, and we encounter them in this passage. If now we increase the velocity of the motion to the highest speed ever attained by a locomotive, say one and one fifth miles per minute, we should encounter more particles, and find a resistance which no human muscle could overcome. Increase the velocity ten times, to twelve miles a minute, (the velocity of sound) and the air would oppose such a resistance that our wooden board would be shattered to splinters. Multiply again the velocity ten times, and not even a plate of boiler iron could withstand the resistance. Multiply the velocity once more by ten, and we should reach the velocity of the earth and its orbit, about 1,500 miles a minute, and, to a body moving with this velocity, the comparatively dense air at the surface of the earth would present an almost impenetrable barrier, against which the firmest rocks might be broken to fragments. Indeed this effect has been several times seen, when meteoric masses moving with these planetary velocities penetrate our own atmosphere. The explosions which have been witnessed are simply the effect of the concussion

against the aeriform anvil at a point where the atmosphere is far less dense than it is here; so in the case of nitro-glycerin, the rock strikes the atmosphere with such a velocity that it has the effect of a solid mass, and the rock is shattered by the blow.

(40) E. W. P. asks: 1. What will dissolve gutta serena? I have tried naphtha, but without success. A. Gutta serena is dissolved readily by benzole, chloroform, bisulphide of carbon, oil of turpentine, and the essential oils generally. 2. Will it answer for mending rubber? A. Yes.

(41) J. H. H. asks: 1. Can you give me information as to the temperature required to melt copper, zinc, lead, iron, and brass? A. Copper 1900° Fah., zinc 773°, lead 617°, cast iron 2780°. The melting point of brass is variable, and depends altogether upon the proportion of its ingredients. 2. How can I make insulated wire for battery use? A. Coat copper wire with gutta serena.

(42) E. says: I have a fine oil painting of the Madonna and Child. It is 30 years old; and from age and ill usage it has become badly cracked. Is there any preparation by which these cracks can be hidden or taken out? A. Its appearance would be improved by careful retouching and varnishing. The taking out of a crack is not possible.

What kinds of colors are used for coloring stereoscopic views? A. Aniline colors are used.

(43) S. G. R. asks: 1. In preparing glycerin we make a lime soap. What is the cheapest and best way of converting that into soda soap? A. Who makes such a lime soap with glycerin? Glycerin forms soluble compounds with lime and soda. 2. What is the best work on the manufacture of soap? A. Moritt's book has a high reputation.

(44) A. S. M. asks: How can I make muffles for baking a charcoal composition in, to render it porous for filtering purposes? A. Muffles are earthenware ovens, usually formed with an oval top and flat bottom. They open at one end and are closed everywhere else, except a few narrow slits in the top and sides.

How is rubber made to retain flock, for piano covers? A. The flock is rolled on while the rubber is in a softened state, by passing between two revolving cylinders heated by steam.

(45) J. M. McC. says: We have a large cistern under a factory, for the purpose of holding rain water for scouring, etc., which has lately been filled partially with hard water, but principally by rain. After letting it stand a few days, we have used said water and it really seems as hard as the well water. Please to inform me why this is? We are confident that it is more than half soft or rain water. A. It is probable that there were sufficient lime salts in the hard water to make all the water in the cistern hard, when the waters mingled together.

(46) P. O. T. asks: In estimating the percentage of tannin in bark, leaves, etc., by means of protochloride of tin and muriate of ammonia, how is the resulting precipitate measured? A. By means of a glass-stoppered cylindrical jar, properly graduated to cubic centimeters.

(47) L. A. W. asks: What is the real cause of the fulling up of flannel by washing? A. It is due to a combination of causes, but principally to the rubbing; and where soap is used, this action is very much accelerated.

(48) W. A. P. asks: What is Berlin bronze, and how is it applied on cast iron? A. The trade does not seem to be familiar with the name.

(49) J. H. P. asks: There is something that is put in tincture of iodine, so that, when the latter is applied to the skin, it leaves no stain. What is it? A. The tincture (so-called) referred to may be obtained by adding, to the alcoholic solution of iodine, ammonia or hyposulphite of soda.

What can be put into ink that will give it a fine gloss, something like a varnish gloss? A. Add some sugar of milk.

(50) G. B. McD. asks: 1. Are platinum and platinum the same? A. Yes. 2. If 10 ozs. 235-6 grains silver be melted with 28 ozs. 9-14 grains platinum, what will the nature of the alloy be as to malleability, ductility, and specific gravity? What will be the melting point of the above alloy? A. Only a trial will answer this, as the properties, etc., of the two bodies are not found in the alloy. 3. Can copper be successfully electro-plated with steel? A. No. 4. How can I procure a list of dates and number of patents issued by the Patent Office since 1858? A. This list will be found in the volumes of the SCIENTIFIC AMERICAN.

(51) P. S. asks: What is ground lime composed of? A. You probably mean sulphate of lime or gypsum, also known as plaster of Paris, which is a combination of lime and sulphuric acid. Gypsum, which has been dried at a temperature at from 400° to 500° Fah., and ground to a fine powder, has the peculiar property, when mixed with water, of recombining with the water, and binding or setting into a hard mass. To this property plaster of Paris owes its value in the arts.

(52) J. T. asks: Why does a sunbeam, admitted into a darkened room through a square, triangular, or other aperture of irregular contour, always form a circular or oval image on the floor or opposite wall? A. In case the opening is of sufficient size, the image will be of the same form as the opening; but when small, other rays enter besides those moving in parallel lines, and (by crossing) approximate the form of the image to a circle.

Observation seems to have given rise to and to confirm a theory that the nearer to the hour of noon the moon changes, the greater is the probability of foul weather; and the nearer to the hour of midnight this occurrence takes place, the greater the probability of fair weather. On what principle is this theory based? A. No satisfactory explanation of these phenomena is given, and the accuracy of these observations is open to grave doubts.

At a certain elevation, above the lower portions of the earth and beneath the summit of the higher portions, there is a line termed the thermal line, because the stratum of the atmosphere at that height is warmer than the strata either above or below it. What is the cause of a greater heat in this stratum than is found elsewhere? A. The existence of this thermal line has only been made known recently; and until the investigations of Glaisher and others are more advanced, explanations would be mere guesswork.

Do rays of light from the sun approach the earth in straight lines? If they do not, in what kind of lines do they approach it? A. They move in straight lines until they encounter the earth's atmosphere, when they are bent into irregular curves by the different refractive powers of the various strata of the atmosphere.

(53) H. C. Z. asks: What am I to use to soften hard rubber balls? A. Boil them for some time in soft water.

What can I use to give old books a better appearance? A. We do not know.

COMMUNICATIONS RECEIVED.

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

On Proportioning Gears. By T. A. C.
On Parasites. By D. V. D.
On Tides. By E. S.
On Hard Rubber Thermometers. By J. M. B.
On Salicylic Acid. By G. H. B.
On Science and the Pope. By G. R.
On Dentistry. By S. B. P.
On the British Patent Laws. By A. H.

Also enquiries and answers from the following:

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

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 enquiries analogous to the following are sent: "Who sells insulated copper wire? Who makes woolen textile machinery (pickers, breakers, and finisher cards)? Who makes horseshoes with movable calks? Who makes balanced slide valves for locomotive use? Who manufactures toy balloons? Who sells platinum, and what is its cost?" 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.]

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Horse yoke, Stratton and Olmsted	161,988	Vise, bench, J. M. Poore	161,984
Horses, etc., quarter boot for, J. P. Gilbert	162,052	Wagon axle skin, R. I. Azbill	162,005
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Ice manufacture and machine, Martin and Death	161,955	Wagon seat, S. Gillingham	161,945
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Insects, switch for killing, S. A. Morrison	161,970	Washing machine, J. R. Barnes	161,884
Iron into steel, converting, S. G. Flagg	162,017	Washing machine, S. J. Morrey	161,899
Jack, hydraulic, E. M. Dudgeon	162,044	Washing machine, Spangler & Reich	162,112
Jack, lifting, H. Brooksmith	161,925	Watch spring equalizer, C. Hanson	161,997
Jack screw, C. K. Marshall	161,974	Water closet valve, G. B. Moore	162,077
Jewelry bezel die, G. Knapp	161,969	Wind wheel, Edwards & Hutton	161,908
Journal for balance wheels, T. Van Dyke	161,915	Windmill, J. Hall	162,062
Kiln, brick, F. D. Rader (r)	6,580	Wire twisting machine, A. De Mestre	162,042
Knife, web, W. B. Burton	162,033	Yoke, horse, Stratton and Olmsted	161,998
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Lamp, R. C. Moore (r)	6,574		
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Lugs, moving, A. Rodgers	161,950		
Loom let-off, H. A. Remington	161,991		
Loom let-off, J. Turner	161,996		
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Meat cutter, J. H. Hollinger	161,981		
Meat, fish, etc., preserving, A. H. Tall	162,119		
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Mowing machine, W. Lorey	162,082		
Mowing machine, J. P. Mabey (r)	6,581		
Nut lock, B. Cranner	162,004		
Nut lock, W. G. Gould	161,949		
Organ action, reed, P. J. O'Neill	161,994		
Pail and lamp, dinner, G. W. Aldrich	161,921		
Paper, bleaching juice for, G. W. Duboisson	162,048		
Paw cutter handle, W. B. Barton	162,014		
Pie, fountain, G. Bader	161,920		
Pencil and crayon holder, P. D. Richards	161,992		
Pencil sharpener, slide, G. W. Choate	161,963		
Piano stool, S. S. Schindler	162,100		
Planting machine, D. L. Toppe	161,993		
Planter, corn, J. Campbell (r)	6,572		
Planter, corn, L. Scofield	162,106		
Planter, hand corn, J. W. Cleland	161,922		
Plate and cutter, pie, W. H. Manning	161,969		

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62,120.—PRESERVING FRUIT.—D. Mefford, Norwalk, O.

DESIGNS PATENTED.

6,580, 6,581.—LEATHER BRUSH BACK.—W. H. Humphrey, Lansingburgh, N. Y.

6,582.—REFLECTOR.—C. M. Murch, Cincinnati, O.

6,583, 6,584.—CASSIMERE.—F. Bosworth, Providence, R. I.

6,585 to 6,588.—EMBROIDERY PATTERNS.—E. Crissand, New Haven, Conn.

6,589.—PIPE.—A. J. D. Henney, Ashland, N. J.

6,570, 6,571.—OIL CLOTHS.—C. Meyer et al., Bergen, N. J.

TRADE MARKS REGISTERED.

2,562.—MOWER & REAPER.—Adrian & Co., Poughkeepsie, N. Y.

2,563, 2,564.—SOAP.—R. W. Bell & Co., Buffalo, N. Y.

2,565.—HANDWARE.—Clark & Co., Buffalo, N. Y.

1,964.—WHISKY.—A. H. Gillette, Syracuse, N. Y.

2,567.—PAPER.—R. J. Harp, New Orleans, La.

2,568.—BITTERS.—J. A. Jackson & Co., St. Louis, Mo.

2,569.—MEDICINES.—E. F. Kunkel, Philadelphia, Pa.

2,570.—CONCRETE STEEL.—Lessey et al., Philadelphia, Pa.

2,571 to 2,573.—WHISKIES.—T. E. Moore, Shawhan, Ky.

2,574.—ENVELOPES.—Porter et al., New York City.

2,575.—MEDICINE.—F. Spreen, Pittsburgh, Pa.

2,576.—JEWELRY.—Thayer Jewelry Co., Astoria, N. Y.

2,577, 2,578.—CORSETS.—U. S. Corset Co., New York City

2,579.—CUTLERY.—W. Brookshire, New York City.

2,580.—MEDICINE.—E. R. Burnham, Chicago, Ill.

2,581, 2,582.—MAGNETS.—C. Phillips, New York City.

SCHEDULE OF PATENT FEES.

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CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA, APRIL 10 to 16, 1875.

4,608.—T. A. Edison, Newark, N. J., U. S. Quadruplex telegraph. April 10, 1875.	
4,609.—Wm. Joselyn, Upper Bedford, P. Q. Combined grain separator and fanning mill. April 10, 1875.	
4,610.—M. A. Johnson, Rochester, N. Y., U. S. Lamp chimney protector. April 10, 1875.	
4,611.—J. H. Weare et al., Cincinnati, O., U. S. Inodorous cooking vessel. April 10, 1875.	
4,612.—O. G. Imlay, Philadelphia, Pa., U. S. Fare device for street cars. April 10, 1875.	
4,613.—H. Aitken, Falkirk, Scotland. Making illuminating gas. April 10, 1875.	
4,614.—F. Charland, Stambidge, P. Q. Movable roof. April 10, 1875.	
4,615.—E. Glendallen, Owen Sound, Ont. Force pump. April 10, 1875.	
4,616.—C. Clamond, Paris, France. Thermo-electric generator. April 10, 1875.	
4,617.—C. Wheeler, Jr., Auburn, N. Y., U. S. Cutting apparatus for harvester. April 10, 1875.	
4,618.—P. Schofield, Philadelphia, Pa., U. S. Steam gage cocks. April 10, 1875.	
4,619.—J. F. Cole, Southampton, Ont. Motive power for churns, etc. April 10, 1875.	
4,620.—H. E. Griscorn, Pottsville, Pa., U. S. Millstone dressing machine. April 10, 1875.	
4,621.—W. S. Sampson, New York City, N. Y., U. S. Furnace or kiln with central draft flue. April 10, 1875.	
4,622.—C. C. Parker, Aymer, P. Q. Potato digger. April 10, 1875.	
4,623.—J. Elliott, London, Ont. Straw and hay cutter. April 10, 1875.	
4,625.—J. P. Abbott, Cleveland, O., U. S. Hanging device for eaves troughs, etc. April 10, 1875.	
4,626.—J. Cowman et al., Rochester, N. Y., U. S. Artificial marble and ornamental stone. April 10, 1875.	
4,627.—J. McKenzie, Kincardine, Ont. Churn. April 10, 1875.	
4,628.—Wm. W. Ingraham et al., Chicago, Ill., U. S. Grain scourer and separator. April 16, 1875.	
4,629.—J. Mattice, Chingunacous, Ont. Alternating screw power. April 16, 1875.	
4,630.—L. H. Hébert, St. John, P. Q. Cultivator. April 16, 1875.	
4,631.—L. H. Hébert, St. John, P. Q. Mowing and reaping machine table. April 16, 1875.	
4,632.—D. McCullough, Kemptville, Ont. Axle offer. April 16, 1875.	
4,633.—Wm. Bowes, Pinkerton, Ont. Windmill. April 16, 1875.	
4,634.—T. De Witt, Chatham, Ont. Plow coulters. April 16, 1875.	
4,635.—James E. Wiener, Friendship, N. Y., U. S. Horse hay rake. April 16, 1875.	

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