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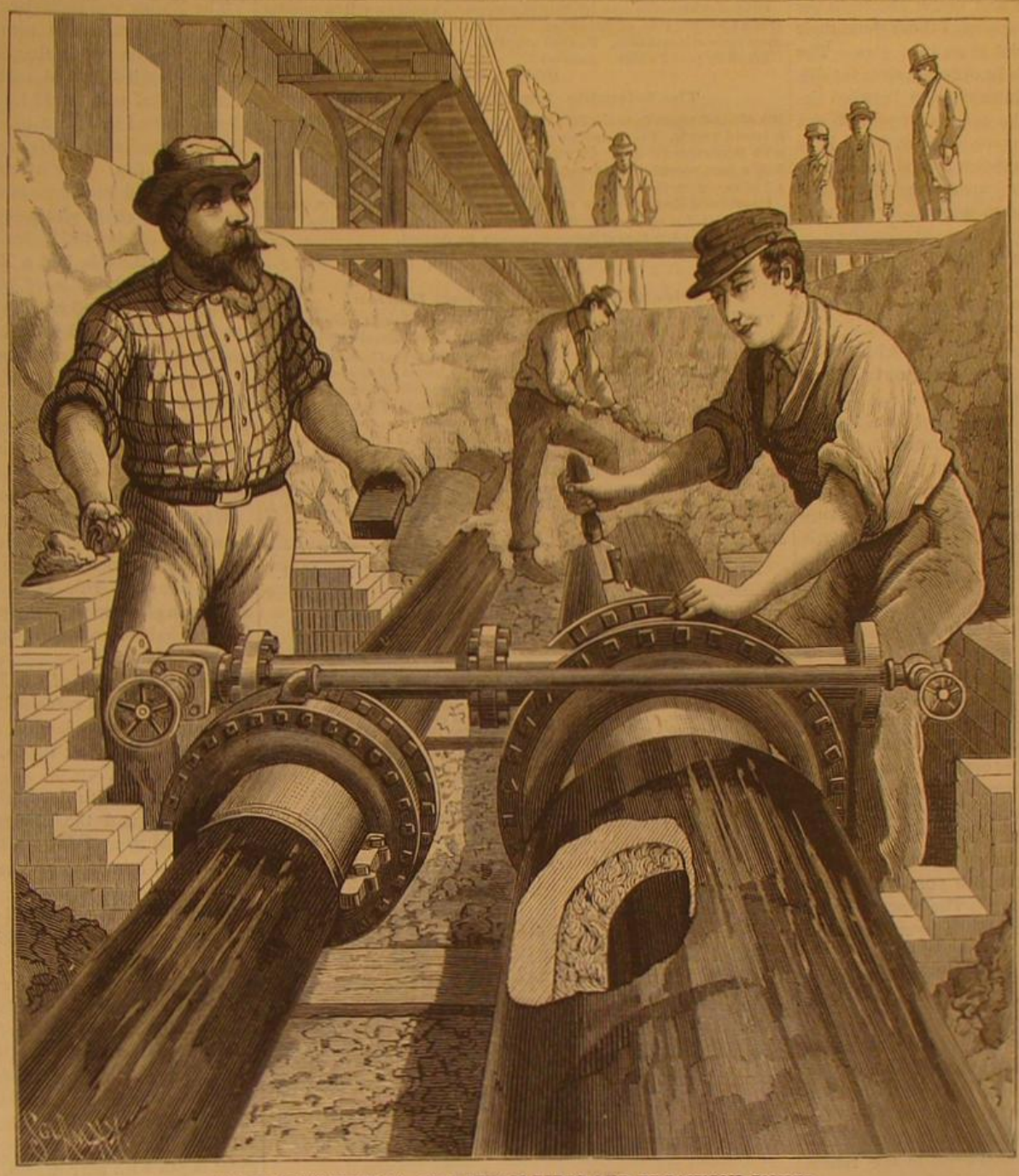
THE DISTRIBUTION OF LIGHT AND HEAT IN NEW YORK CITY.

The tendency of the day toward the centralization of capital and effort, and the simplification of domestic service through more perfect organization in the supplying of our material wants, is strikingly illustrated in two gigantic enterprises now in progress in this city, both dealing in problems of vital importance in social and domestic economy, and both calculated to do away with time-honored customs and methods.

We have become used to elaborate and wide-reaching systems of conveyance, which have displaced the use of private carriages—to a large extent even the use of the means of conveyance which nature provides. Equally wide-reaching systems of telegraph and telephone lines have brought every man in the community within hailing distance of every other. Our water supplies are laid on in every apartment by means of public water systems employing scores of miles of large aqueducts and thousands of miles of smaller pipes. Night is converted almost into day for us by illuminating gas supplied from central stations. And the next steps of social and domestic organization promise to be the distribution of motive power with our illuminant, and the displacement of our heaters and cooking stoves by steam conveyed through the streets in pipes, making it possible to banish fire absolutely from our dwellings, offices, and factories, either for warming or lighting, for cooking or for mechanical operations, heat, light, and motive power being generated in and supplied from huge central stations.



STEAM DISTRIBUTION—THE STEAM PIPES AND EXPANSION JOINTS.

Although electric lighting and steam heating have nothing in common, the circumstance that progress in each is represented by gigantic enterprises in vigorous prosecution in this city makes it proper to treat of them together in this place.

On the Eastern side of our city, down town, the Edison Electric Light Company is placing a complete system of conductors in the streets, while the New York Steam Company is occupying the streets on the Western side in the work of laying down pipes for the general distribution of steam for heat and power. The central stations of both companies are in process of erection, and preparations for business are making with a prospect of early completion.

The Edison Electric Light Company has laid about three miles of conductor in an area scant three-quarters of a mile square, south of Spruce street and east of Nassau street. When this district is complete there will be fourteen miles of conductor under the streets and seven miles of service conductor. These conductors will supply 16,000 lamps, and 400 horse power for driving machinery.

The operations of laying the conductors is shown in Fig. 1. In a trench about two

LAYING THE EDISON ELECTRIC MAINS—THE SERVICE BOXES AND EXPANSION JOINTS

NEW ENTERPRISES IN NEW YORK CITY.

feet below the surface are laid pipes containing the conductors, the pipes and conductors terminating at intervals in boxes forming a sort of expansion joint. The pipes are cemented in the boxes with an elastic insulating cement, and the conductors are connected by copper loops which are capable of springing sufficiently to compensate for expansion and contraction. These loops are soldered to the conductors, a cylinder of compressed gas and a blowpipe being employed for this purpose.

Fig. 2 represents a service box in which the two copper loops are provided with arms extending to one side of the box and attached to service conductors leading to the building to be illuminated.

The conductors might be described as half round. They are of drawn copper of the size and shape shown in the transverse section, Fig. 3, and are supported throughout their entire length by insulating material in an iron pipe. The conductors thus mounted are made in different sizes for different localities, as there is a definite relation between the interest on the investment and the price of coal. When coal is cheap the conductors are made smaller, when it is dear they are made larger. Throughout a system the conductors are of the same size, and they are connected together at the corners of the blocks so as to practically increase capacity of the system.

Various forms of boxes are shown in Figs. 5, 6, and 7. Fig. 4 shows a street connection for the purpose of making electrical tests and for special purposes. There are thirteen varieties of street boxes and five for buildings.

The central lighting station is to be provided with twelve large Edison generators requiring 2,200 horse power. These machines are in process of construction.

The works in Goerick street are turning out from twenty to twenty-four of the smaller generators per week.

The New York Steam Company is placing pipes in Greenwich street, while at the same time an immense boiler house or heating station is being erected on the same street to supply steam to one of the ten districts into which the city is divided. The majority of the stations are located, and the work in the district in progress is being advanced with all possible speed.

The boiler house is something over 100 feet in height, and contains four floors of boilers, with sixteen boilers on a floor, making sixty-four boilers, having an aggregate of 15,000 horse power. The two chimneys of this immense boiler house will be a little taller than Bunker Hill Monument. The steam from these boilers is to be discharged into large vertical pipes or separators—to separate the water from the steam—whence it passes into the street mains, of which there are five, two of ten inch, two of twelve inch, and one of twenty-four inch diameter. These huge pipes are laid in sections, connected together by expansion joints of peculiar construction which permit the pipes to expand and contract without injury. The pipes are protected from the effects of external cold by a layer of mineral wool surrounded by a wooden jacket.

A return pipe runs parallel with the supply pipe to carry the water of condensation back to the boiler house. This pipe is much smaller than the supply pipe and is protected in the same manner. The steam pressure is generally relied on to force the water back, but in case of a great inclination in an adverse direction, a pump will be employed to force the water back. Steam will be taken from the supply pipes for heating, for cooking, and for power, and the water of condensation will be delivered to the return water pipe. We are unable in this connection to give the details of the steam meter or of that portion of the system that relates to the building.

This system is based upon the inventions of Mr. B. Holly, but the credit for the perfection of the system is due in a great measure to Mr. C. E. Emery, engineer of the company.

Accidents at the Paris Exhibition.

The correspondent of the London *Times* reports in that paper's issue of the 4th Oct., the following accidents at the Exhibition. He says:

"Yesterday a gentleman was leaning over a balustrade to examine an extremely interesting machine of M. Christofle, when his gold chain made a connection between two conducting wires which happened to be exposed. His chain became red hot and set fire to his waistcoat. To-day I had some conversation with a gentleman who was nearly killed the other day by a Brush dynamo electric machine. Part of the conducting wire was not insulated and was lying on the floor. He touched the stand of a lamp which formed part of the conducting system. His body then formed a connection through the ground to the naked wire, and contracted his muscles so as to cause his hand to clinch the lamp. Ten lamps were in circuit at the time, and so much current was passed through him that eight of them were extinguished. He was powerless to unclasp his hand. Every muscle in his body was paralyzed. His face was distorted; his lungs were so acted upon that he could scarcely breathe. He could only utter a faint and unnatural cry. The workmen in the place fled from the workshop, believing that some explosion was about to happen. A friend came up and tried to unlock his hand. It was impossible. He then lifted his legs from the ground. This broke the circuit and his hands were released, while burning sparks flew to his hands in the action of breaking the circuit. He was insensible, but has since then greatly recovered, and has devised an improvement to the lamp which will prevent a recurrence of such an accident."

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NEW YORK, SATURDAY, NOVEMBER 19, 1881.

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(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT.

No. 307,

For the Week ending November 19, 1881.

Price 10 cents. For sale by all newsdealers.

THE MADGE AND HER VICTORIES.

For two or three years the interest in English yacht racing has centered mainly in the ten tons class. The results of 1879 proved beyond a doubt that the Madge was the best British ten-tonner afloat. The next year she met her match in the Neptune and later in the Maharanee. The champions of the past season were the Neptune and the Buttercup, the former winning substantially everything in the north, the latter everything in the south. The record of the Madge, however, is a proud one, she having won in three years fifty-six prizes out of sixty-eight starts. Foreseeing possibly a better chance for continued victories in other waters, the owner of the Madge had her brought by steamer to this port to try conclusions with American craft.

The Madge was built by G. L. Watson, of Glasgow, in 1879. Her dimensions are: Length over all, 45 feet 8½ inches; on the water line, 38 feet 9 inches; beam, 7 feet 9 inches; depth 6 feet 6 inches; draught, 7 feet 10 inches. Her keel is of oak, 10x12 inches, to which is bolted nearly eleven tons of lead; her inside ballast is only 500 pounds. The stem and stern posts are of oak. Every third frame is oak, 2x3 inches. The intermediate frames are of elm, 2x1½ inches, spaced twelve inches from center to center. In the wake of the chain plates the frames are double. The deck beams are of elm, 3x2¾ inches, placed twenty-four inches apart. On these is laid a light deck of pine. Below the water her planking is of oak and elm, 1½ inches thick; above she is planked with cedar. She is coppered to above the bends. Her deck is flush, and she has no bulwarks. Her mast is 36 feet in extreme length, and 8 inches in diameter at the partners. Her boom is 36 feet long; gaff, 26 feet; bowsprit, outboard, 20 feet; topmast, 26 feet; spinnaker boom, 40 feet. She carries an enormous spread of canvas, the fitting of which is superb. Her extreme narrowness and great depth are in striking contrast with the breadth and shallowness of American small craft.

With these differences in style of construction came disputes as to the proper vessels to match with the Madge. The representative of the Madge refused to sail except upon the water line area rule of measurement—a rule which few American clubs recognize, and which shut out from competition vessels of an actual capacity corresponding with that of the Madge.

The first victories of the Madge were won over the Seawanhaka course in races with the Schemer, whose dimensions are: Extreme length, 38·95 feet; at water line, 37·17 feet; beam, 14.5 feet; depth, 4·6 feet; draught without center board, 3 feet.

In two races with the Shadow, at Newport, the Shadow won the first and the Madge the second. The dimensions of the Shadow are: Length over all, 36 feet 8 inches; water line, 33 feet 5 inches; beam, 14 feet 4 inches; depth, 5 feet; draught, 5 feet 4 inches.

The Madge was also sailed against the Wave at New York and at Newport, winning both races.

A race was refused with the Gracie of the New York Yacht Club, whose length over all is 48 feet 9 inches, and on water line 44 feet, a difference in favor of the Gracie considerably less than that of the Madge over the Shadow.

The controversy seems to hinge on the question whether length, breadth, and depth shall be taken as factors of capacity, or length and breadth only, a question which yachtsmen will have to settle for themselves.

Seeing that stability and speed can be secured either by great depth with narrowness, or by great breadth of beam with light draught, it would seem as though there ought to be some satisfactory means of determining fairly the comparative rating of the two types of vessels.

That the two methods of measurement and estimating time allowances are important elements of the problem may be seen from the fact that, applying the rules of the Atlantic Yacht Club, the Madge was beaten in all of her races save one, the New York race with the Wave.

THE ST. GOTHARD TUNNEL.

The first complete railway train, carrying one hundred passengers, passed through the St. Gothard Tunnel, Tuesday, November 1, time fifty minutes.

The St. Gothard Tunnel, nine and a third miles long, pierces the Helvetic Alps, and forms a link in the St. Gothard Railway, connecting the Swiss railways with those of Upper Italy. It exceeds the Mont Cenis Tunnel in length by 8,856 feet. The northern end of the tunnel, Goeschenen, is 82 feet from the southern end of the station platform, situated 3637·5 feet above the sea level, and 2,204 feet above Lake Lucerne. From this point the line rises with a gradient of 1 in 171 for 24,600 feet, then with a gradient of 1 in 1,000 for 4,428 feet, where it reaches the highest point of the tunnel 3,785 feet above the sea. Then after a length of 1,279 feet it descends with a gradient of 1 in 200 for 3,870, when the gradient is reduced to 1 in 500 for 13,792 feet, which brings it to within 984 feet of the platform of the station at Airolo, situated 3,755 feet above the sea, and 3,109 feet above Lake Majeur. The normal width of the tunnel is 24 feet 11⅞ inches at the level of the rails, and 26 feet 3 inches at the height of 6 feet 6 inches above the rails. The height of the tunnel is 20 feet; the roof is semicircular. The floor of the tunnel is formed with a fall of 2½ per cent from each side toward the center, and at the lowest part is a drain 21⅞ inches deep. Up to the level of the top of the railway sleepers the floor is filled with ballast. The nature of the revetment varies with the rock traversed. In addition to the main tunnel there are fifty-two subsidiary tunnels on the line, having a total

length of 16 miles, and 64 bridges and viaducts. Of the entire length of the St. Gothard line 17 per cent is tunneled and 1 per cent bridges and viaducts. The main tunnel carries two lines of railway, 4 feet 8½ inches gauge.

The contract for the work was taken by Mr. L. Favre, August 9, 1872. The construction was begun at Airolo, September 24, and at Groeschenen October 24, 1872.

IS INSANITY INCREASING?

It is a common saying that an increase in the number of insane persons is one of the necessary results of the intensity of modern life. There is certainly a steady increase in the number of inmates in asylums for the insane, an increase greater than the growth of population would seem to warrant. For this there may be several causes:

1. An actual increase in the proportion of persons of unsound mind in comparison with the entire population.

2. A more general and systematic commitment of insane persons to asylums for protection and medical treatment.

3. A steady accumulation of insane persons owing to the better care of the insane and the consequent lowering of the death rate of such persons.

That the second and third causes are real and potent is amply sustained by the statistics of our public institutions. The proportion of insane persons at large naturally diminishes with the improvement and multiplication of asylums and the growing popular conviction that neither individual nor public well-being is furthered by allowing the insane to go free, uncared for, and without medical assistance; and as a natural result the number of the insane in asylums increases proportionally.

Accordingly we may have an increase in the number of annual commitments to asylums, as well as in the number of permanent occupants, without any increase in the total percentage of insanity in the country.

Increased efficiency in the medical treatment of the insane may also seem to increase the number of cases as well as the actual number under care at any time. With unskiliful treatment many cases of acute mania may result in speedy death, or, what is worse, chronic insanity. In such cases the patient counts but once. With better treatment the patient is ultimately, often speedily, discharged, apparently or really well. The disease is liable to recur, however, and in the course of years the same patient may have to be under treatment several times, each time adding one to the statistics of insanity.

Another fact which tells against the theory that "high pressure" living tends to unhinge the mind may be found in the source of the larger portion of the inmates of insane asylums. The records of asylums show that most of the insane come, not from the busy professional, mercantile, and manufacturing classes, but from those whose lives are a monotonous round of petty drudgery, or, what is equally killing, petty inaction, unfruitful idleness, and dissipation. Frivolity probably leads more men and women to the insane asylum than the hardest and intensest pursuit of mental or material wealth.

RAILROAD INVENTIONS WANTED.

Notwithstanding the fact that the past twenty years have witnessed wonderful improvements in railway fixtures and appliances there yet remains a wide field for mechanics and inventors to labor in in this direction. The fact that there are more than 2,000 existing patents on car couplers is no evidence that the demand is supplied. On the contrary, a *good automatic coupler* is among the needs of American railways, and the inventor who will produce a satisfactory coupler will not only be regarded as a public benefactor, but at least a dozen fortunes are at his command. A complicated rattletrap of an affair will not do. One that is plain, simple, durable, and reliable at all times is what the railway public are looking for and will, undoubtedly, pay handsomely for when found. There are a few of the couplers that have been brought out lately that are not entirely without merit, but they are lacking in many of the essential points of a perfect coupler.

The foregoing has reference solely to freight cars. The couplings now in use on passenger trains are, in the main, satisfactory, but for freight service *the* coupling is yet to be found. Here are some of the requisites of a perfect coupler: Any number of cars coming in contact should be coupled automatically. But it should be so arranged that no coupling will be effected unless so desired. It is obvious that if cars coupled at all times when they came in contact it would cause trouble in switching and yard work. The coupling must be so arranged that it can be operated from the tops of cars or on the ground without going between them. By "operated" is meant that a brakeman can uncouple from the top of a car or he can "set" the coupler so that it *will not couple* if so desired, and an operater on the ground can do the same thing without going between the cars. Next comes durability, which may be regarded as the "mountain in the path."

Chief among the causes of railway disasters are misplaced switches. It is true that we have safety switches that are reliable, but as their use (like many other good things) has not become general, there is a demand for a *reliable* switch signal. It is also true that we have some very good switch and drawbridge signals, but they do not always prevent accident, which may be accepted as proof that they are defective in some vital points. We have reports of from seven to twelve accidents from misplaced switches monthly, and accidents of this class are usually of a serious nature, being destructive of life and property. In August last eleven accidents are reported from this cause, and it is certain that many accidents from misplaced switches are not reported, and we have from three to five drawbridge accidents yearly. About a year since a $40,000 accident occurred at a drawbridge in New Jersey, and the draw was provided with an electric signal, but it appears to have become deranged. Some of the interlocking signals now coming into use are so arranged that if they get out of order in any manner the signal always stands at danger. This would seem to render switches and draws absolutely safe, but accidents are yet far too frequent, and although we have greatly improved these appliances they have not yet reached perfection.

Another fruitful source of frequent and serious disasters is imperfect signals at railway grade crossings. Crossing collisions are frequent and disastrous, and a signal that will effectually prevent this class of accident is in demand. Signals for the purposes named above should be of such a nature that they cannot be either misunderstood or run past unnoticed.

For daylight or clear weather targets or semaphores may be arranged so as to be effective, but on foggy days or at night the gong, bell, or torpedo should be brought into use. Interlocking signals are in use to a considerable extent, but they are mostly of a complicated and delicate nature and liable to become deranged. Moreover, there are such a diversity of signals that those who operate them and those who are to be governed by them are liable to become confused and the results are disastrous. Accidents have frequently occurred by the engineers passing a distant signal which stood at safety when it was passed, but was changed with the switch or draw before reaching the home signal or switch or draw, and the home signal not being visible by reason of fogs, or obscured by curves in deep cuts, buildings, piles of lumber, etc. No switch, draw, or crossing is safe without both a home and distant signal, both interlocking. And there should be intermediate signals at short intervals between the distant and home signals, and all connected with the switch or draw and operated with the single movement that operates the distant signal. As signals trusting to the vision for safety are not reliable at all times, the bell or gong must be brought into use. The torpedo may also be made to give warning of danger by a simple mechanism connected with switches and draws, by which a number of the explosives may be automatically placed on the rail at proper intervals.

The American Humane Society some time since offered a prize of $5,000 for the best stock car, but at their recent annual meeting, at Boston, they decided that none of the many hundred designs so far submitted came near enough to the requirements to entitle any one to the prize. The offer is now open, and it is hoped that some one will soon win the prize.

The above hints may be worth something to inventors working in the directions indicated.

WM. S. HUNTINGTON.

[In respect to the prize offered by the Humane Society, one of the conditions was that the successful plan should be protected by a patent which should be assigned to the society. In these days of industrial progress it is idle to suppose that any patentee of a perfected cattle car would sell his patent for the small sum of $5,000. Such a patent would be worth more nearly five hundred thousand dollars than five thousand. We have good authority for the statement that the offer of the Humane Association had the effect to call out a number of highly valuable cattle car inventions, the patents for which were at once bought up by the Palace Cattle Car Company at figures a little above those offered by the association. This left in the hands of the association only the inferior plans, none of which were found to be within the association's offer; hence no award could be declared. The Palace Cattle Car Company ought to feel greatly obliged to the association for its arduous and gratuitous services in assisting it to acquire its valuable patent rights at a tithe of their real worth. Ten millions of dollars, we believe, is the amount at which the car company now values these patents; at any rate that is the par value of the company's stock, which we believe is based chiefly on these acquisitions.]

NEW COMPRESSED AIR LOCOMOTIVE ON THE ELEVATED RAILWAY, NEW YORK.

A trial was made on the Second Avenue Elevated Railroad of a new air locomotive on the 23d, and again on the 28th of October, with entire satisfaction to the Pneumatic Tramway Engine Company, who own the machine. In this locomotive air at a high tension is stored in tanks and distributed to the motive cylinders through a reducing valve and then through hot water, according to an old and well known plan, for the purpose of heating it, to counteract the refrigerating effect of the expansion of the air, and also to provide moisture as a lubricant for the pistons.

This locomotive was built by the Baldwin Locomotive Works, of Philadelphia, and is the invention of Mr. Robert Hardie, of Edinburgh, Scotland. It is on the same principle and an improvement on a street motor that was tested and reported on by General Haupt, whose report was published in the SCIENTIFIC AMERICAN SUPPLEMENT of June 28, 1879, No. 182. The obvious advantages of a noiseless exhaust, and the absence of fire, with its disagreeable odors, dust, and smoke in a street motor, are claimed for this locomotive, and so far as the experiments are concerned which have taken place in the last few days on the Second Avenue Elevated road, the claim is well established.

The locomotive, as shown in our engraving, consists of four steel cylindrical air tanks of very perfect construction, having dished heads and triple riveted spiral seams in lieu of the usual longitudinal form, and double riveted circumferential seams, all of which are made tight by means of Connery's calking, and tested at a pressure of 850 pounds to the square inch. These tanks, having an aggregate capacity of 460 cubic feet, are supplemented by two smaller distributing tanks, a small steam generator, and a pair of motive cylinders, similar to steam engine cylinders, 12½ x 18 inches, with Stephenson link reversing gear and adjustable cut-off on the back of the slide, connected in the usual manner to four coupled 42-inch driving wheels. The cab is located at the forward or cylinder end of the machine. The method of hanging by means of equalizing levers between the drivers and an improved two-wheeled swinging center bearing pony truck effects the distribution of eighty per centum of the weight upon the drivers, and practically carries upon three points of the frame, thereby avoiding undue strains and securing steady motion over the inequalities of the track. The initial air pressure is 600 pounds to the square inch at starting, but is distributed to the motive cylinders through the distributing tanks, reducing valves, and steam boiler, at a uniform working pressure, about the same as that of ordinary locomotives. A small fire is kept burning in the furnace of the steam generator, which is a small upright tubular boiler. For the purpose of obtaining a high grade of expansion and a noiseless exhaust, the cut-off is arranged on the back of the slide, as above stated, which is instantly adjustable to any desired grade by means of an ingenious hand device within the cab.

A new and peculiar feature of this engine is the use of the main cylinders for working the vacuum brakes, which is done by simply putting the reversing lever in mid-gear, when the main cylinders become vacuum pumps, thereby greatly simplifying the handling of the train.

On the 26th of October we had the pleasure of a ride on this admirable engine, and we testify to the perfect manner in which it fulfills its mission as a noiseless, odorless, smokeless, and perfectly controllable motor. It will cover the full length of Second Avenue, from 127th Street to the Battery, with four loaded cars, at a higher rate of speed than the schedule calls for, with a single charge of air, and then the recharging is done in as short a time as is needed to change horses on a surface road.

The engine is now in charge of John A. Wallace, one of the "L" road engineers, who is more than pleased with it, and especially is he delighted with the absence of anxiety about boiler water, which is the steam locomotive driver's bugbear.

Curious Experiment in Crystallization.

The following experiment is given by Peligot in *La Nature:* Dissolve 150 parts by weight of hyposulphate of soda in 15 parts of boiling water, and gently pour it into a test tube so as to half fill it, keeping the solution warm by placing the glass in hot water. Dissolve 100 parts by weight of acetate of soda in 15 parts of hot water, and carefully pour it into the same glass; the latter will form a layer on the surface of the former and will not mix with it. When cool there will be two supersaturated solutions. If a crystal of hyposulphate of soda be attached to a thread and carefully passed into the glass, it will traverse the acetate solution without disturbing it, but on reaching the hyposulphate solution will cause the latter to crystallize at once in large rhomboidal prisms with oblique terminal faces. When the lower solution is completely crystallized, a crystal of acetate of soda similarly lowered into the upper solution will cause it to crystallize in oblique rhomboidal prisms. The appearance of two different kinds of crystals will not fail to surprise those not acquainted with such experiments.

Early Steamers in England and Canada.

At present (1814) there are five steamboats on the Thames. 1. The Thames (originally the Argyle), 14 horse power, plying between London and Margate; reckoned the best boat. The paddles alternate with each other, and are set at an angle of 45 degrees. 2. The Regent, 10 horse power, paddles set square, with rims like an overshot wheel; is expected to ply between Chatham and Sheerness. She was first built for the wheel to work in the middle; but this, not having been found to answer, has been altered. 3. The Defiance, 12 horse power, to Margate, with double horizontal cylinder engine. 4. A boat which plied between London and Gravesend was laid aside on account of a lawsuit, as she was not worked by a privileged person. Such a person has now taken her, and she will soon start again with a new 12 or 14 horse power Scotch engine, being originally fitted with a high pressure engine. The wheels of this have rims, and the paddles swing like top butt hinges. 5. A boat with double keel, 6 horse power, is now building above Westminster Bridge; paddles upright; said to be for London and Richmond. 6. Mr. Maudslay built a small boat last year for Ipswich and Harwich, 16 miles done in two and a quarter hours, but against a strong wind in three hours. This has six frying pan paddles set square, without rims. I have been informed, by letter of August last, from Gainsborough, of a steamboat from thence to Hull, which performs the voyage, 50 miles, in eight hours. And this week, from Canada, at present there are two steam vessels on the river St. Lawrence, one 48 the other 36 horse power, which go at 7 miles an hour, measure about 170 feet long and 30 feet wide! Another 48 horse power vessel will be launched next year on that river. So that one may go by steam from Quebec to New York in eight days, with a short land carriage.

ALLEN'S PORTABLE COMPRESSION RIVETER.

This riveter is principally intended for beams and girders for bridge building, and forms the rivet head by compressing the end of the rivet into a suitable die. The bars, turning on a fulcrum, contain at one end the dies, and are connected at the other end to a toggle joint, to the center of which the piston rod of a pressure cylinder is attached. The arms C and D, are made interchangeable, so that the machine with arm, C, as represented in Fig. 1, will straddle the edge of girders or beams having six inch angle irons on each side, and when arranged with the lever, D, as represented in Fig. 2, plates may be riveted on to six inch channel iron.

The pressure used in this machine is from fifty to sixty pounds, and the arms are made of sufficient strength to operate on one inch rivets. The weight of the machine complete is about seven hundred and fifty pounds. It can be operated by steam or air, but for the convenience of handling the machine air pressure is recommended.

In consequence of the peculiar construction and arrangement of the elbow or toggle joint between the power employed for operating the machine, and the hinged or pivoted arms which carry the dies, a small ten inch cylinder will produce, at the end of the stroke or when the dies are nearly closed, a pressure upon the rivet of about fifty tons, or about one ton for every pound of pressure upon the cylinder piston.

This machine is in use in the principal bridge and wrought iron works in the country.

Further information in regard to these machines may be obtained by addressing Mr. Henry E. Roeder, manager of Allen Portable Riveting Company, 304 Broadway, New York city.

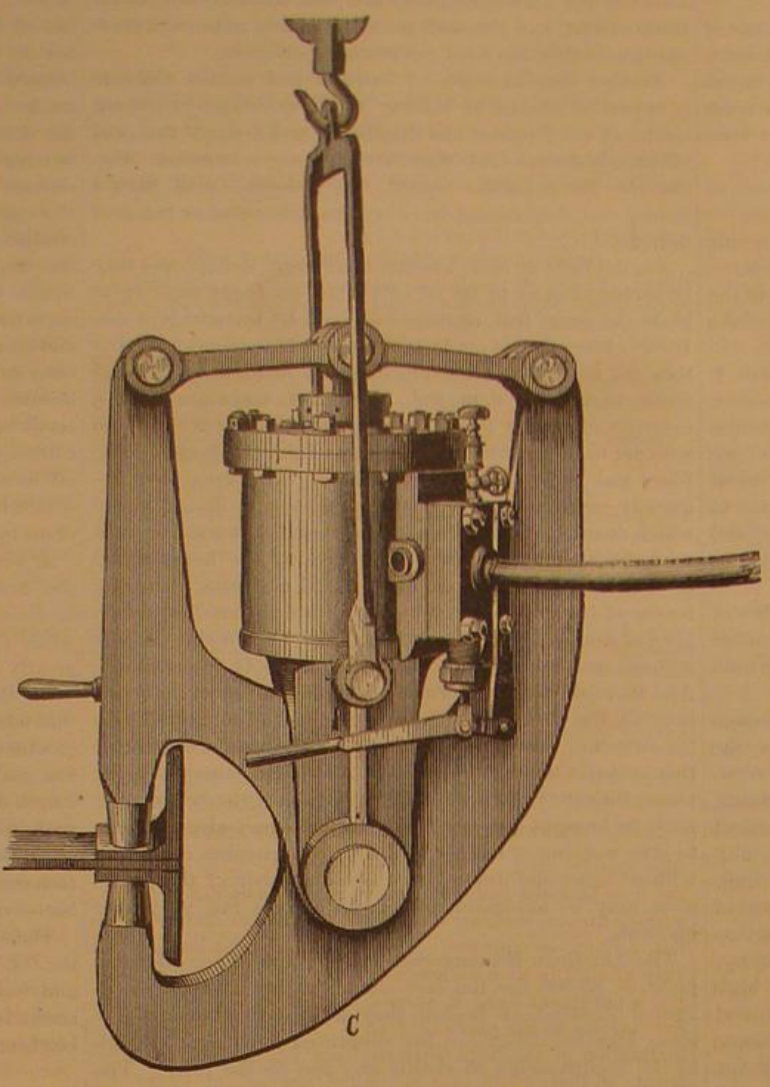


Fig. 1.—COMPRESSION RIVETER.

The Year's Work of the Signal Corps.

In his annual report to the Secretary of War, Gen. Wm. B. Hazen, Chief Signal Officer, summarizes as follows the work done by the Signal Corps during the past year:

"This year has been distinguished by additional progress and by decided improvement, which I will briefly recite: The establishment, under your sanction, of a permanent school of instruction at Fort Myer, Va.; the raising of the standard of the *personnel* of the Signal Corps; the systematization of the duties of the Signal Service; the preparation of new instructions for observers of the service; the preparation of new and improved forms for the recording and preservation of meteorological data; the preparation of special bulletins for the press, containing weather information of public interest; the forecasts of weather, of hot or cold waves for periods exceeding twenty-four hours; the forecasts of 'northers' for the interior plateau; the adoption of a new storm signal (the cautionary northwest) for the interior lakes; the arrangement for increase of river service and wider publication of the international bulletin and the monthly weather review, with their accompanying charts; the increased information added to the farmers' and to the railway bulletins; the organization of a service for the special benefit of the cotton interests of the South; the extension of the special frost warning to the fruit interests of the country; the investigations into thermometric standards and into barometric standards; the preparation of new hygrometric tables containing correction for altitude; the revised determinations of the altitudes of Signal Service stations; the computation of monthly constants for the reduction of observed barometric pressures to sea level; the arrangements for original investigation in atmospheric electricity, in anemometry, and in actinometry, and in the last subject, especially with reference to the importance of solar radiation in agriculture and the absorption of the sun's heat by the atmosphere; the co-operation in an expedition to the summit of Mount Whitney, California; the determination of problems in solar physics in meteorology; the preparation of conversion tables for the English and metric systems; the co operation in the dropping of time-balls at Signal Service stations; the publication in quarto form of special professional papers; the offering of prizes for essays of great merit on meteorological subjects; the organization of State weather services; the new investigation of danger lines on Western rivers; the organization and equipment of two expeditions for meteorological observation and research in the arctic regions of America, one to be stationed at Lady Franklin Bay, the other at Point Barrow, Alaska, both co-operating in this work with a system of stations established in the polar region by international conference; the establishment of a system of stations of observation in Alaska; the arrangements for organizing a Pacific coast weather service; the display at the Paris Electrical Exposition; the experiments for improving newspaper weather charts; the increase since June 1 of telegraphic weather service, exceeding in value $34,000 per annum, without additional expense to the United States, and the extension and construction of military telegraph lines.

"One hundred new stations have been established in the cotton belt during the year, the total number of stations of observation in operation June 30, 1881, within the territory of the United States and maintained for the Signal Service being 296. Reports are also received from 17 stations established by the authorities of the Dominion of Canada; also from one at St. John, Newfoundland, and one at York Factory, British America. The cost of maintaining each full station of observation during the year, exclusive of the cost of telegraphing and the pay and maintenance of the enlisted men, has been $336.73, a decrease since the preceding year of $45.55 per station."

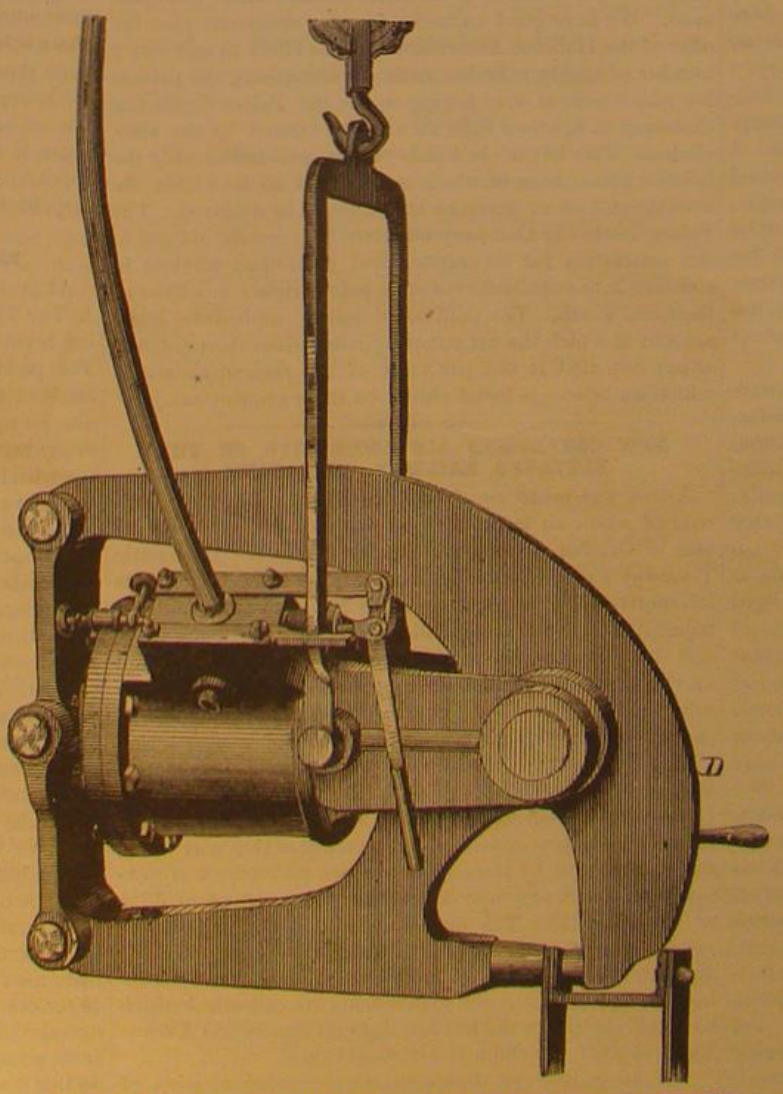


Fig. 2.—ALLEN'S PORTABLE COMPRESSION RIVETER.

MECHANICAL INVENTIONS.

An improvement in sewing machines has been patented by Mr. Jacob R. Scott, of Nyack, N. Y. The object of this invention is to insure uniformity in the movement of the presser bar by the upward stroke of the needle bar and secure uniform feed of the material. It is specially designed for use with the boot and shoe machines described in patents Nos. 232,559 and 233,560, so that they may be adapted conveniently for the sewing of hose, where no variation of thickness is required.

An improved carriage spring has been patented by Mr. Ronella L. Doble, of La Grange, Me. This invention relates to the use of a chord rod in combination with elliptical springs, and has for its object to strengthen the springs.

An improved machine for bundling kindling wood has been patented by Mr. William A. Allen, of Jersey City, N. J. This machine forms the bunch of wood into a cylindrical bundle, squares up the end of the bundle, and holds the wood in compact shape until it is tied.

An improved machine for grinding wood for paper pulp has been patented by Mr. Nicolaus Kaiser, of Grellingen, Switzerland. The invention consists in a grinding stone mounted on a suitable shaft and surrounded by a casing, with a series of boxes on the sides for containing the blocks of wood, which are pressed against the sides of the stone by a rack and pinion actuated by a weight, or by springs or hydraulic pressure, whereby the block of wood is converted into a wood pulp.

Mr. Michael Waters, of New York city, has patented a sensitive steam engine governor that will operate, when additional work is thrown on the engine, to instantly open the valves for the admission of a corresponding head of steam into the steam cylinder, so that the usual "slacking down" of the engine on such occasions shall be avoided, and economies in power or fuel and in time be thereby obtained.

Messrs. John L. Metcalfe and John T. Metcalfe, of Quincy, Pa., have patented an improved grain separator. In this machine, the bars of the rake bed connect with the upward incline from the thrashing cylinder by bars arranged to form a trough, which greatly facilitates the early separation of the grain carried up by the straw. Combined with the main shoe is a supplemental shoe shaken at both ends and having a transverse slot in its bottom fitted with a roller and a comb, whereby a better separation of the clean grain and tailings is effected. There is also combined, with the fan head or fixed register plate, a detachable box bolted to the fixed head and forming the bearing for the revolving register plate, thereby greatly facilitating renewal and repairs. Combined with the elevator box and elevating belt is a screen shaken by said belt to separate sticks and other foreign bodies from the tailings, and provision is made in a convenient and efficient manner for connecting and disconnecting the straw carrier by the machine while in motion.

A very effective and simple machine for making tent pins has been patented by Mr. Friedrick W. Evers, of St. Louis, Mo. The invention relates to machines for finishing tent pins, that is to say, pointing them, cutting the notch, and shaping the head. In this machine the pins or stakes, cut to size and of wedge form, are first pointed by inserting them singly at their smaller ends, through a rest, into a hollow cutter head on one end of a revolving mandrel. They are then arranged side by side upon a sliding inclined bed, or endless apron, and passed at their larger ends under a pair of cutter heads, secured one in advance of the other on the opposite end of the mandrel, and having a presser bar between them to hold the pins down. The cutters on these cutter heads give the required bevel to the heads of the pins, and cut the inclined notch, also bottom of the notch, thereby completing each pin.

A very valuable improvement in boot and shoe lasting machines has been patented by Mr. Solomon B. Ellithorp, of Rochester, N. Y. This invention is an improvement upon a machine previously patented by the same inventor, and consists in an adjustable construction of certain parts, whereby the machine is more readily adapted to shoes and boots of various sizes. The seat for the heel of the last, and the seat for the toe of the last are both adjustable vertically and longitudinally toward or from each other. Likewise the clamps, which are provided with eccentric levers for adjusting the gripe of their jaws on the leather, are connected with the templet by vertically adjustable hooks, and the templet is adjustable in direction of its length by the levers and devices which control it. Furthermore, the pressing screw bolt, which holds down the last on its seat, is adjustable laterally as well as vertically, so that its pressure may be applied to any part of the bottom of the last.

Mr. Horace L. Kingsley, of Racine, Wis., has

patented an improved platform gear for wagons. The invention consists in a platform gear into which the two outside bars are made of metal and U-shaped in their transverse section, and are provided at their ends with plates bolted on or between their walls to the head block and front brace bar, wooden or other filling pieces being inserted in the outside bars. This construction furnishes a platform gear of light and durable character, and a rigid frame is formed having the upper surface of its bars level for receiving the bearing circle.

Mr. Stephen D. Engle, of Hazleton, Pa., has patented an improved pantograph engraving machine for engraving on metal, for reducing maps and drawings, and similar work. This machine can do almost any kind of engraving from a pattern. It enables an unskilled person to do a good job of engraving.

Messrs. Robert Barber and Burchard H. A. Siefken, of Omaha, Neb., have patented a machine which will separate from auriferous sand or earth the fine as well as the larger particles of gold with the use of only a small quantity of water. The invention consists, principally, of a washing tank communicating with a tailing tank, in which revolves a wheel provided with pivoted or swinging scoops or buckets for removing the tailings without unnecessary waste of water, the washing tank being provided with suitable conveyers, riffles, and amalgamated plates.

An improved station indicator has been patented by Mr. Virgil H. Sprague, of Greene, Me. The inventor makes use of endless belts or chains, carrying the name cards or plates, and fitted with mechanism for giving step-by-step movement to the belt, whereby the cards are successively exposed.

An improved station indicator has been patented by Mr. Zebina M. Hibbard, of St. Louis, Mich. This invention is designed as an improvement on the station indicator for which Letters Patent Nos. 209,122 and 214,776 were issued to the same inventor October 22, 1878, and April 2, 1879, respectively.

An improved type-writer has been patented by Mr. George H. Herrington, of Wichita, Kan. The object of the invention is to furnish type writing or printing machines occupying small space and adapted for use in banks, stores, and other places for registering time, amounts, and other information in connection with money received and paid. A dial and a type wheel operated by a stem carrying a hand for indicating on the dial the position of the type wheel are used. Combined with these is a paper-carrying cylinder fitted for rotation and transverse movement. The dial, type wheel, and rotating mechanism are all carried by a ring-shaped case having a tubular boss and connected by a knuckle joint with the top of a post, whereby the case may be swung to and from the platen. The shaft which operates the rotating mechanism extends through the boss of the case and is manipulated by a knob outside of the latter. This shaft or stem is moved longitudinally to set the type to and from the paper and to move the cylinder carrying the paper the necessary space between the letters. An elastic band serves to hold the types in place and to raise them after an impression.

IMPROVED DINNER BUCKET.

In the dinner bucket shown in the engraving, the body, A, tapers and its ends are rounded. In one end of the body there is a vessel, B, for holding fluids, such as coffee, tea, and milk. In the other end of the body there is a box, C, having one or more compartments for holding articles of food, such as meats and preserves. These two vessels are removable from the bucket.

The cover, D, is crowned, forming a chamber which is closed by the plate, E. This chamber is used for holding articles that may be safely carried either side up. This forms a very compact dinner bucket of very convenient form. It is the invention of Mr. John B. Schneider, of St. Jacobs, Ill.

Photographing in Theaters.

In one of the new theaters now approaching completion there will be a photograph gallery, where the portraits of visitors can be taken by lime light. This is a capital idea, and many people, especially ladies, will doubtless avail themselves of the opportunity to be taken in evening dress, the facilities for which purpose are not at present great. A photograph is pre-eminently a thing done in a hurry and on the impulse, and few people would send a ball dress to the photographer's the day before and put it on by daylight in his boudoir; while the other alternative, of driving in evening dress down street at noon, is still more distasteful. Quite naturally you go from the dinner table to the theater, and in the same dress *from your* box to the operating room.—*London Court Circular.*

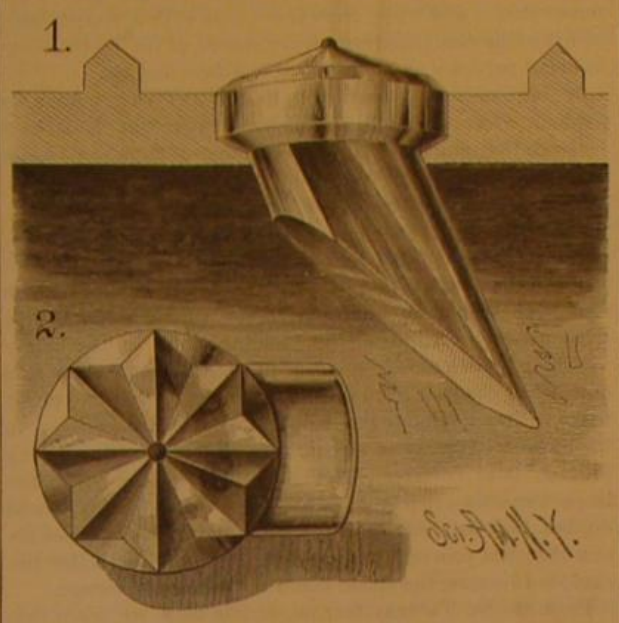
A NOVEL TOOL CHEST.—A burglar recently arrested in Leadville, but discharged for lack of evidence, is now limping about Colorado with the tools of his profession neatly concealed in his wooden leg. This convenient receptacle was not discovered by the jailer until after he had received instructions to release his prisoner.

TILE FOR ILLUMINATING PURPOSES.

The engraving shows a novel illuminating tile for pavements, vault covers, and similar purposes. The object of the improvement is to increase the quantity of light admitted and to diffuse it over a large surface.

The invention consists in an illuminating lens of semi-prism form having a very large reflecting surface.

The engraving shows a portion of a vault or pavement plate or frame fitted with the illuminating lens made of crown glass. The lens or semi-prism is formed with a flanged top portion to fit a flanged opening in the plate. The upper surface is formed with a raised center and with radiating grooves having beveled sides to increase the extent of surface. The beveled surfaces being depressed are protected from abrasion. The upper surface may, however, be of simple conical form, or in certain situations a plain flat surface may be used. The downwardly extending portion of the lens is a semi-prism having an inclined flat reflecting surface and an inclined back face that may be flat or nearly flat, convex, or concave. The angle of the flat surface will vary according to location, and is of the first importance. For a pavement light it should be slightly less than forty-five degrees to the plane of frame. It is lengthened by the inclination of the back surface from the head to the lower point, so that while only a limited amount of material is used, thereby saving weight and loss of light, an extensive reflecting surface is obtained at the proper angle.



PENNYCUICK'S ILLUMINATING TILE.

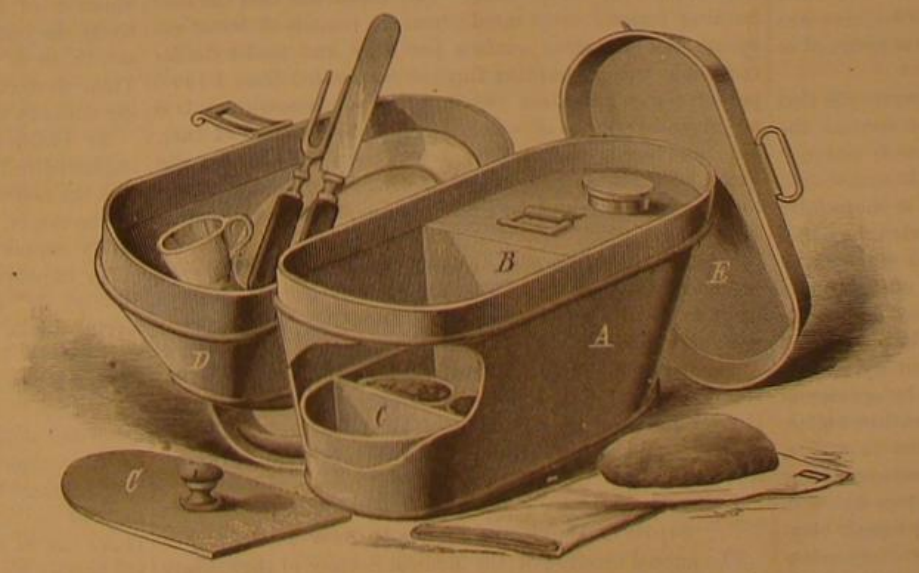
At the center of the upper surface there is a metal spur which projects slightly and protects the surface. The iron frame is formed with knobs or projections between the tiles, so that the feet of persons walking over the frame shall be kept entirely off the lens, and slipping will be prevented.

This invention has been patented by Mr. J. G. Pennycuick, of Boston, Mass.

The Names of the States.

The Hon. Hamilton B. Staples read a paper at the annual meeting of the American Antiquarian Society in Worcester, on the 21st inst., in which he discussed the origin of the names of several of the States. His conclusions were as follows:

New Hampshire gets its name from Hampshire, England. Massachusetts is derived from an Indian name, first given to the bay, signifying "near the great hills." Rhode Island has an obscure *origin;* the island of Rhodes, the "Island of the Roads," and a Dutch origin, "Red Island," were mentioned, the first seeming to have the best historical support. Connecticut is an Indian name, signifying "land on a long tidal river." New York, New Jersey, Pennsylvania, Delaware, and Maryland were passed over. Virginia, the Carolinas, and Georgia have a royal origin. Maine was named from the fact that it was supposed to contain the "mayne portion" of New England. Vermont has no especial question, except that it is claimed to have first been an alias—New Connecticut, alias Vermont. Kentucky popularly signifies either a "dark and bloody ground," or a "bloody river," but its origin signifies "the head of a river," or "the long river." Tennessee comes from its river, the name being derived from the name of an Indian village on the river—"Tanasee." Ohio is named after an Indian name, signifying "something great," with an accent of admiration. Indiana comes from the name of an early land company. Illinois comes from the Indian—the name of a tribe. Michigan is claimed to mean "lake country;" it probably came from the name of the lake, "Great Lake," which bore this name before the land adjacent was named. Louisiana is from the French. Arkansas and Missouri are Indian, the former being doubtful; the latter is claimed to mean in its original "muddy water," which describes the river. Iowa is also Indian, with doubtful meaning. Texas is popularly supposed to be Indian, but may be Spanish. Florida is Spanish, "a flowery land." Oregon has a conjectural origin. It is probably Indian, but a Spanish origin is claimed. California comes from a Spanish romance of 1510. Nevada takes its name from the mountains, who get theirs from a resemblance to the Nevadas of South America. Minnesota is Indian, "sky-tinted water." Nebraska is variously rendered "shallow water" and "flat country." Kansas is from an Indian root, Kaw, corrupted by the French. Mississippi is "great water," or "whole river." Alabama is Indian, the name of a fortress and a tribe, signifying, as is claimed, "here we rest."



IMPROVED DINNER BUCKET.

Southern Woods and Ores at the Atlanta Exhibition.

One of the notable exhibits at the Cotton Fair is a fine display of Southern woods, both rough and polished. It includes the sweet gum, a light colored wood, often worked up for coffins; the tupello, a tree that cuts like cheese, but cannot be split, used by the negroes for corks; the famous (and infamous) palmetto; the Spanish bayonet, with stiff blades sharp as needles and serrated edges; the swamp cypress, with its pointed excrescences three feet high springing from the root; and the curled pine, which takes a grain polish like the curled maple, but infinitely more vivid and beautiful.

The Georgia saw mills—there are eight hundred of them in the State—have sent in some colossal pine logs, one of them a sylvan monarch, straight as a needle, seventy feet long, twenty inches in diameter at the smaller butt, and some four feet thick at the base.

In the same building are two collections of Southern minerals, chiefly from Georgia, remarkable for their variety, utility, and number. Among them are fine specimens of copper and copper ore, sheets of clear mica a foot square, coal blocks weighing half a dozen tons, crystals, stalactites, and gold nuggets, one of the latter worth five hundred dollars.

Odd Things that have been Found about the Wrecks of Vessels.

The Coast Wrecking Company has in its office, in this city, a curious collection of relics from old wrecks and other odd bits taken from the sea. The collection embraces quaint pieces of furniture, explosive shells, and shells of the ocean, shreds of ladies' dresses, rude weapons of savage races, huge starfish, and many curious things, the use and purpose of which are still unknown. The collection contains the broken bell brought up from the ill-fated steamer Atlantic, of the White Star line, which was wrecked on Golden Rule Rock, on the Nova Scotia coast, on April 1, 1873, with a loss of 557 out of 1,007 souls on board. There is also a rusty, hiltless sword, dug out of the sand eight years ago, near the hulk of the British bark Thistle, which was lost on Squan Beach, N. J., in 1811. There are also several bottles of sweet oil, holding a pint and a half each, with the original corks intact, and the oil as clear as crystal, taken in November, 1877, from the wreck of the British bark Robert, which went down in 1844, with a cargo of lead and oil, and five of her crew, off the place where Atlantic City now stands. There is a South Sea Island canteen, ingeniously constructed of cocoanut shells, which was fished up from a wreck in seventy feet of water on the coast of Maine; also a mussel shell firmly embedded four inches in depth in a well which was found one hundred and forty feet above the sea level on the Jersey coast; also a pelican's skull and bill, measuring two feet from back to tip (making an excellent though wide dipper) which was found near the wreck of the bark Robert Fletcher, on the south beach of Long Island, and which is said to have been used to bail out the boat by the crew when endeavoring to escape. The jaws of a shark, killed on the South Carolina coast, which have been preserved, can easily be passed over the shoulders and down the body of a full-grown man. One of the most curious relics is a lamp chimney taken from the remains of the ironclad Merrimac. Oysters three inches long were found attached to the glass, and four large oysters which had grown about the

brass base of the chimney, form an irregular square. The hilts of several swords and some old firearms are also incrusted with oyster shells.—*New York Sun.*

STEAM BOILER NOTES.

On the 29th of October the Cincinnati Board of Aldermen passed to be engrossed an ordnance making the use of an effective smoke-consuming furnace compulsory on the part of all manufacturers and others whose business requires the use of a chimney that has become a nuisance to the neighborhood. Organizations, including a society of ladies, have been formed in Cincinnati for the purpose of procuring the abatement of the smoke nuisance.

In regions where bituminous or other smoky fuel is used because it is readily obtained and cheap, an enormous waste is made, not only from imperfect combustion, which results in the smoke nuisance, but also from the sooting of the fire surfaces of the boiler. Considerable improvement has been made in Eastern cities of this country by the introduction of deeper boiler furnaces and devices for supplying air above the fire to complete the combustion and by skillful firing so as to coke the coal near the mouth of the furnace. But it is probable that very much fuel, not only bituminous but anthracite also, is still sent out of the boiler chimney in the shape of invisible gas of a combustible nature as well as black smoke. The remedy, both for the smoke nuisance and loss incident to the collection of soot on the boiler fire surfaces, is no doubt attainable, and should engage the attention of inventors with a view of producing a cheap and simple regenerating gas boiler furnace. As showing what may be possible in this direction we abstract from a paper by William Metcalf, of Pittsburg, Pa., which was read before the Engineers' Society of Western Pennsylvania, and which we find in the *Iron Age*. He shows how much money is annually wasted through the smokestacks of Allegheny County, Pa., in shape of dense black smoke and the still more wasteful burning gas at the top of iron furnace stacks. The loss is made apparent by a comparison of the old and the new style of iron puddling and reheating furnaces, the old being the common reverberating and the new style the regenerating gas furnace. The quantity of coal used in the old furnace is from 30 to 40 bushels per ton of puddled iron, while in the gas furnace 20 to 30 bushels of slack, costing half as much per bushel, will produce a ton of iron, and after deducting the cost of gas making in the new process the net gain in cost of fuel is 38½ per cent in the puddling process. In the reheating furnaces the saving in cost of fuel is 30 per cent. Moreover, the loss by oxidation or scaling in the old furnaces is 224 pounds per ton, while in the new furnaces the loss is only 134 pounds. Estimating the loss in dollars, or rather the possible saving, it aggregates nearly four dollars per ton of bar iron once reheated. Allegheny County appears to have made, in 1878, 250,000 gross tons of rolled iron, so that its contribution to the smoke nuisance and the red chimney torches cost about $1,000,000. Steam users will do well to make a note of this. A good gas boiler furnace appears to be an object worth looking for.

The boiler of a thrashing machine engine exploded at Martville village, N. Y., Oct. 29, killing Frank Milliman and terribly injuring eight others. Milliman was completely disemboweled and died in half an hour. Frank Timerson, the owner, had a piece of iron driven through his groin and cannot recover. One little boy had his hip broken in two places and his knee shattered. Another had his skull fractured, and there is little hope of his recovery. Others had their arms and legs broken and badly shattered. One man was blown twenty feet. Low water in the boiler is assigned as the cause.

It is to be regretted that the idea so generally prevails that some steam boilers will not explode while they contain the usual supply of water, because when low water is assigned and believed to be a sufficient cause in any case it seems to cut off further inquiry. No fact in engineering is more fully established than this, that boilers have exploded, meaning broken into fragments with similar detonating phenomena to that which attends the bursting of rocks on igniting a contained charge of gunpowder, while they are known to have contained sufficient water to fully protect the plates from overheating. This has been abundantly proved by experiment, and it is being almost daily confirmed by accidental explosions. Formerly when Cornish and Lancashire boilers having unsupported tubular furnaces were more in vogue, so much so as to be the prevailing types, the collapse of the furnaces from the softening of their uncovered tops was very frequent in England, but since the custom of properly staying such parts has become prevalent, and since every attendant knows that his first duty is to see that such boilers have an ample supply of water, their failure from this cause is very rare, so much so, a celebrated English authority has declared, that it is probable that more flues and furnace tubes collapse from irregularity of form and from other weaknesses than from shortness of water. The locomotive and other forms of internally fired boilers are often injured by overheating of the furnace tops. But this injury is not always fatal unless accompanied by a higher pressure than the crown braces or stays can sustain. Crown plates are often bagged between the braces, which is pretty strong evidence of overheating, and if such a condition existed of the crown plate of an exploded boiler it would be strong evidence that the water had been too low or the pressure too high, and if in addition to the stretching or bagging of the plate between the braces it bore other evidence of the effects of heat on a dry plate, such as the cracking off of the surface scales and a change of color to a peculiar shade, their low water might be confidently assigned as a cause of the explosion, because it has so weakened the boiler that it broke down under its load.

But the once popular notion that an explosive gas is generated in a boiler by overheating its fire surfaces should be entirely set at rest by the late experience in tubular coil boilers, which have water regularly thrown upon their heated surfaces and which send over to the engine steam as inexplosive as that coming from the surface of water in old styles of boilers. This experience should likewise demolish the theory of the evolution of steam with an explosive suddenness capable of instantly shattering the strongest boiler.

The discoloration of plates of exploded boilers which occurs from a sharp bending of the plate while wet, is often mistaken for evidence of overheating, but it has quite a different shade, and when fresh is covered with a recent layer of red oxide resulting from the exposure of the bright fibers or small particles of the metal to moisture and air.

It has not only been well established that boilers do explode while containing sufficient water, but it is now believed that much the larger percentage of explosions result from weakness, either congenital or acquired, or from overpressure resulting from sticking of the safety valve. Although many defects in construction result disastrously, still it seems trivial to cavil and dispute about the weakest point in the construction of a boiler when it can be shown that even that weak point was many times stronger than what was supposed to be the yielding point of the safety valve, and when an extensive acquired weakness, such as a cracked or grooved seam or an absolutely immovable safety valve, is found among the ruins after the explosion, or, in their absence, plenty of circumstantial evidence all pointing to such fatal defects. Intelligent and experienced boiler inspectors often criticise construction, as of right they should do, but they are not generally captious critics of construction that has proved amply safe if they find the boiler has exploded because the steam could not otherwise escape.

From the St. Thomas *Journal*, of late date, we learn that a most distressing accident occurred on board the propeller Canada, at the docks of the New England Transportation Line, which, from evident suppression, escaped the press until developed by a fatal termination and a coroner's inquest. The boiler of the Canada needed cleaning. The second engineer, Thomas Brown, went inside of it, while fireman Muir held a light at the man-hole. John Clark, one of the hands, passed in some oil for loosening the scale. The boiler was a trifle warm, and the oil, scattering somewhat, caused an escape of gas, and ignition, and then a fearful explosion. John Muir was blown ten feet away, and his eyesight in an instant obliterated forever. The engineer crawled out a mass of fire and flames, his shirt burned and his flesh roasted. In this terrible condition he lingered until Thursday and died in untold agony.

In the SCIENTIFIC AMERICAN SUPPLEMENT of March 13, 1880, was published an illustrated account of experiments with gas-fired steam boilers made by Mr. Heaupt, of Brieg, at the works of the Lower Silesian Mining Union. The illustrations include sixteen drawings of boiler furnaces and gas producers, and show the best methods of bringing the gas and air in contact and the steps by which the most favorable results were obtained.

A trial was then made, continuing for eleven hours, in the most practical manner, by placing gas burning and coal burning furnaces in competition. The result was that the coal burning furnace evaporated about 2½ pounds of water per square foot of heating surface per hour, and under similar conditions the gas burning furnace evaporated from 4·4 to 5 pounds per square foot per hour. The economic result is not given in pounds of water evaporated per pound of fuel, but in experiments made previously by MM. Müller and Eicht, of Paris, an economy of 32 per cent of fuel is stated to have been attained in Upper Silesia, Dortmund, and at Essen.

A boiler at the Worcester (Mass.) Dye and Bleach Works exploded October 24. William Ronayne was scalded badly and had a leg broken. Wm. Dick and Martin Davis were also scalded.

The boiler in Samuel Johnson's sawmill, near Gistville, Henry County, Ky., exploded October 31, killing David Hoover and mortally wounding John L. Johnson, Pleasant Hensley, and Jennes Hall. Five others were seriously injured.

Sanitary Work and Needs in New York.

The annual meeting of the Medical Society of the County of New York, October 24, was devoted mainly to the report of the Committee on Hygiene. The chairman of the committee, Dr. John C. Peters, said that as far back as 1865, a council of hygiene, composed of the best physicians in the city, decided that diphtheria and scarlet fever were more virulent and abundant in the neighborhood of filthy stables than in other localities. It was the same with infectious pneumonia and severe diseases of the eyes. There is a cheap process of baling manure which could be easily adopted in large car, omnibus, and livery stables. This prevented fermentation, rotting, and offensive odors, and made the manure a valuable article of export to the Southern States, as it was easily and cheaply handled. In small stables it might be packed in barrels, and Dr. Peters said it had long been carried on steamboats in this way without its presence being known. These plans would do away with all the manure vaults in the city of New York, many of which were under the sidewalks, and exceedingly offensive. As the stables were for the most part in the best sections of the city, the abatement of this nuisance would add more to the health and comfort of the people than any one thing except the suppression of the 15,000 or 20,000 privy vaults, only too many of which were in the central part of the city between Fourth and Sixth Avenues. These vaults were said by the Board of Health to cause more sickness and death than any other one thing, and the manure vaults were only second to them.

Reports were read from Sanitary Inspector Day, stating that the Board of Health would ask for four additional sanitary inspectors, two meat inspectors, of which none now existed, two additional disinfectors, two additions to the vaccinating corps, and three engineers to enforce the provisions of the new plumbing bill, all of which, and more, the Committee on Hygiene hoped would be granted.

The Board of Health had made 94,000 inspections, of which 24,000 were of tenement houses, and 5,400 were found objectionable. The Board inspected 8,000 privy vaults, of which 4,300 were found to be full, filthy, or out of order. Thirteen hundred inspections of stables were made, and 475 were discovered to be in a filthy condition. The first six months of the present year 3,400 dead horses, 8,500 dead dogs and cats, 80,000 pounds of bad meat, and 70,000 barrels and boxes of decaying fruit and vegetables were removed. Eight hundred and forty barrels of zinc and iron disinfectants were used, and, although made of old tin cans, pails, and the like, served the purpose remarkably well. One thousand gallons of carbolic acid and 13,000 gallons of dead oil were also used. During the past nine months there had been 14,000 cases of contagious diseases, of which 1,100 were smallpox, 5,000 scarlet fever, 4,000 diphtheria, 2,000 measles, 600 spotted typhus fever, 600 typhoid fever, and 500 cerebro-spinal meningitis. The wealthier classes were responsible for a great deal, as they owned the better part of the worst tenement houses and stables, with their disgusting vaults and manure pits.

A communication was read from Dr. Janeway, Commissioner of Health, and also a member of the Committee on Hygiene, calling attention to the provisions of the new plumbing bill, and stating that typhus fever had been absolutely eradicated. Diphtheria had prevailed more extensively during the last three months than at any time since 1875. Dr. Janeway thought the greatest sanitary need of New York was an increased supply of water, and he believes that to the short supply was due a great many deaths. The death rate at one period reached 56 in 1,000. At the same date the death rate in London was only 18 in 1,000. For many weeks, Dr. Peters stated, it had been above 30 and 40, and in London it rarely reached 20. The highest death rate in London was 31, and that was reached only once.

The society elected the following officers for the ensuing year: Dr. F. R. Sturgis, President; Dr. W. Gill Wylie, Vice-President; Dr. W. M. Carpenter, Secretary; Dr. P. B. Porter, Assistant Secretary; Dr. O. B. Douglas, Treasurer; Drs. D. Lewis, E. F. Ward, E. B. Bronson, D. Webster, and A. Jacobi, Censors.

MISCELLANEOUS INVENTIONS.

A changeable and perpetual calendar, of durable construction and in convenient form, has been patented by Mr. Jabez Bath, of Brooklyn, N. Y. This invention consists in a combination of cards and numbered blocks indicating respectively the year, month, days of the week, and days of the month, or a slide will suffice for the days of the week. These devices are inserted within suitable recesses on removing slides in the frame for the purpose.

Mr. Philip Herbold, Jr., of Galion, Ohio., has patented an improved bed lounge having hinged sections. It is so made that the mattress will not be obstructed by any central ridge in the center, and when used as a bed the center rails are firmly supported.

An improved whip socket, patented by Mr. William A. Bradley, Jr., of Bridgeport, Conn., consists of a glass socket having a hole in the bottom for the escape of any water that may enter. It is provided with a simple clamp, by means of which it may be fixed to the dash board.

An improved coal shovel, which can also be used to sift ashes and separate them from the cinders, has been patented by Mr. Charles H. Siarin, of Brooklyn, N. Y. The invention consists in a slotted or perforated shovel with a plate pivoted to each longitudinal edge of the bottom, which plates can be raised to close and cover the perforated or slotted bottom by means of a wire pivoted in the handle and provided with an extension, which can be depressed very conveniently by the person holding the shovel.

An improved compound cut-off cock has been patented by Mr. James Mullaney, of New York city. The object of this invention is to facilitate the controlling of a water supply from two distinct sources through the same delivery pipes.

An improved running gear for vehicles has been patented by Mr. Er Harder, of Berkshire, Ohio. The object of this invention is to construct a wagon or bob sled gear especially adapted for use on rough roads and for making short turns. The front and rear axles are pivoted and connected together by chains.

Messrs. Charles W. Spickerman and Jeremy R. Martin, of Winnebago City, Minn., have patented an adjustable square for marking siding boards for a house, in order to cut perfect joints when the house casings or corner boards are beveling or drawn back by nailing.

NEW INVENTIONS.

A sugar skimmer and cooler has been patented by Mr. Augustus B. Lanier, of Oliver, Ga., which is not only effective, but simple and inexpensive, and admits of being easily cleaned and fitted to ordinary concentrating boilers for cane juice. The device consists of a lower perforated section having the form of an inverted funnel, and provided with a central collar, an outside rim, and inclosed concentric rings, and an upper section having an outside raised flange, legs to support it on the lower section, a downwardly-projecting perforated cone, and a guide rim on the under side of the latter.

Messrs. John E. Clement and John A. Enos, of Peabody, Mass., have patented a machine for whitening leather. The invention consists in a machine for planing off the surface of leather, usually termed "whitening leather," which embraces several important features, including a rocking hub for carrying the rotating cutter head, and whereby the cutter is made to act in a level plane; a feed bed having an elastic support to hold the work up to the cutters by spring pressure, and which is carried by a slide operated by a toggle joint mechanism to admit of the bed being adjusted squarely and bodily as required; a compact arrangement of mechanism for vibrating the rocking hub, and for rotating the cutter head carried by the latter, and a series of straight cutters within the cutter head, constructed to avoid that lateral thrust of the leather, which is incidental to the usual spiral blade cutter. The machine is light and portable, and is said to do its work both rapidly and perfectly.

Mr. Nicholas Scholl, of Chillicothe, Ohio, has patented a bosom board, which secures a perfect stretch and taut but elastic hold of the bosom of a shirt. The invention consists in an ironing board provided at its upper end with a head formed of a wire frame having downward projecting ends, from which spiral springs pass to near the outer ends of the board, the collar band of the shirt resting against these springs, when the bosom is stretched and held in position by means of a spring clamp formed of a transverse strip having a longitudinal tongue fitting in a groove in the end of the board, which strip is held to the end of the board by spiral springs.

An improved lubricating device for supplying oil to a bearing intermittently, has been patented by Mr. George C. Herrich, of Auckland, New Zealand. This device consists of an oil cup provided with a tubular plug at its base for entry within the bearing to be lubricated, a stem or rod fitted loosely and longitudinally through the tubular plug, and a piston or puppet valve fast on the stem or rod and fitted to play freely within a chamber above the plug. The motion and vibration of the machinery, or irregularities on the shaft acting upon the lower end of the stem, cause the piston or puppet valve to rise and fall, and thereby allow the oil to flow intermittently from the cup around the piston and stem and down through the bore of the plug to the bearing.

Mr. Charles E. Robinson, of Charlotte, N. C., has patented an improved process and furnace for volatilizing and oxidizing ores, especially such as contain a large proportion of gold and silver. The invention consists in subjecting ore, when in a pulverized or comminuted state, to the action of a fire blast, and driving or producing a continuous circulation through a continuous passage until the desired effect has been produced. It also consists in a combination with an ore-reducing chamber and furnace chamber, of an ore-conducting pipe, and a steam, air, or gas-injecting pipe, arranged in such relation with each other that the steam or gas jet or current produces an induced fire blast and creates and maintains a circulation of the pulverized ore through a continuous passage. By these improvements a complete and thorough volatilization and oxidation of the baser elements and preparation of the same for elimination from the more valuable metals are effected with the least expenditure of fuel and labor, and the largest yield of valuable metals is obtained at minimum cost.

Mr. Simon P. Harbaugh, of Cumberland, Md., has patented a very simple but efficient hand-power press for baling hay, cotton, wool, rags, etc. The power is applied by bearing down on a hand lever carrying hooked dogs which engage with ratchet wheels fast upon a shaft that has its bearings in the sides of the press. Upon this shaft are pinions which mesh with racks carried by a frame that is fitted to slide up and down within grooves and slots in the end boards of the press body and upward extensions thereof. To this rack frame the follower is connected by hinged bars. Applied to the ratchets are pawls for retaining the follower in position while the operating lever is being raised to further compress the material or to tie the bale. These pawls are formed with fingers which rest upon the hooked dogs, whereby, when the lever is raised and the dogs come in contact with the lifting studs, both the dogs and pawls are disengaged from the ratchets, and the follower is free to be quickly readjusted.

Mr. Carl G. Buttkereit, of Des Moines, Iowa, has patented certain improvements in bell pianos. This invention consists in a combination with the bells, arranged one within another, of rods for supporting the bells, bent to be about parallel with the inside of the latter; also in a combination with these devices, of a rod secured to the bell frame at one side of the bells and serving to carry the several bent rods which support the bells, likewise means for holding and adjusting the bent rods to their places. The invention also comprises a spring wire provided with a cushion head against which the rod of the hammer strikes when moving toward the bell, to soften the sound and prevent clattering of the hammer on the bell, a damper adjustable in or on the damper lever relatively to the bell, and a laterally sliding damper apron frame.

An improvement in sash cord or chain fasteners, which has for its object the fastening of a sash cord or chain to the sash so that it can be readily attached or detached without removing the parting strip or stop bead, has been patented by Messrs. Thomas P. Dunne and Paul Rath, of New York city. The invention consists in a flanged and ribbed sleeve, through which the lower end of the sash cord is passed, the strands of the cord being separated and turned down on the outside of these ribs, and held thereon by a screw cap, which is passed over these ribs and is screwed into the lower end of an angular inclined aperture passing from the outer edge to the inner surface of the side rail of the sash, through which angular aperture the cord passes. If a sash chain is to be held, the short sleeve is provided at its inner end with two prongs, between which the chain is passed.

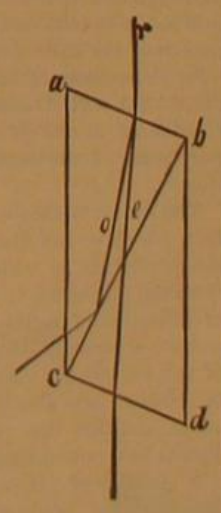
Mr. Joel Davis Hall, of Kingston, Ga., has patented an improved machine for sharpening cotton gin saws, in which the saw to be sharpened is carried by a shaft, and intermittently fed or rotated one tooth at a time by a helically constructed rotating feeder, to expose the several teeth of the saw in succession to the action of the sharpening file. The sharpening device is a rotating file mounted upon a nearly vertical shaft, which is carried by an intermittently sliding frame that has its movements timed to correspond with the revolution of the feeder and thereby caused to put the file into and out of contact with the saw as required.

An improved animal poke has been patented by Mr. Lorenzo Stow, of Rome, Tenn. The poke is composed of two rigid, looped, or slotted side pieces suspended from a headstall and designed to rest against the jaws of the animal. A horizontal bent or double bar engages and slides on the side pieces, and has a smooth or rounded end to come in contact with the animal's throat.

The Nature, Formation, and Uses of the Nicol Prism.

Previous to the time when the late Mr. Nicol, of Edinburgh, discovered those principles in Iceland spar which led to his admirable invention of the prism bearing his name, the phenomena of polarized light had received but a limited degree of attention, while its application to the microscope might be considered as comparatively unknown. It is of all the apparatus employed in the polarization of light that which possesses the greatest popularity, and is, consequently, in most extensive use; and this position it will retain until some crystal possessing the properties of tourmaline, but of larger dimensions and free from its objectionable color, shall have been discovered.

The nature of the Nicol prism will be comprehended from the following: When any object, such as a piece of printed matter, is viewed through a rhomb of Iceland spar, or calcite—a crystallized form of carbonate of lime, also known as calc spar—such object is seen in duplicate, owing to the double refractive powers possessed by this crystal. Physicists have designated these rays respectively the ordinary and the extraordinary; and when either of them is got rid of that which remains is distinguished as polarized. Mr. Nicol's ideas relative to having this separation made of the two rays culminated in his cutting asunder, by means of a fine saw, a rhomb of spar at the line *b c* in the cut, and rejoining the two pieces by Canada balsam.



Into a rhomb of spar, *a*, *b*, *c*, *d*, a ray, *r*, from any object enters, and in virtue of the double refraction alluded to becomes split up into *o*, the ordinary, and *e*, the extraordinary ray. Both these rays encounter the oblique film of Canada balsam, *b c*, the extraordinary ray passing through without hinderance. Not so, however, is this the case with the other ray, which falls at such an acute angle upon the balsam—which has a refractive index intermediate between that of the spar for the ordinary and extraordinary rays, and thus, acting for the former the part of a totally reflecting mirror, sends it away to one side, where it is absorbed by the black surroundings of the mounted prism, leaving only the extraordinary ray to emerge at the end, which it does as a polarized ray of light.

Two prisms of the kind described form a polariscope. The object to be examined is illuminated by light transmitted through one of them, thus designated the "polarizer," while it is viewed, with or without the aid of a magnifying glass, by the other, which is then termed the "analyzer."

A Nicol prism forms an agreeable and often useful pocket companion when one is boating, fishing, or enjoying a walk in the country, and this quite apart from what scientists may term its more elevated uses. The glitter of the bright sunshine causes a sheen or glare to be reflected from the surface of the water which is quite fatal to the carrying out of the desire to peer down in the depths and examine into the beauties of the submarine world. The "Nicol" is applied to the eye as an eyeglass, or mounted in duplicate as a small opera glass, and, presto! the glare and reflection from the surface are annihilated, and the water is imbued with a crystalline transparence. We are aware of one instance in which the body of a drowned man was thus discovered reposing "at a few fathoms deep;" and the majority of scientists know what is meant by the "fisherman's spectacles," which are composed of a pair of Nicol prisms, and by which the user is enabled to see how and to what extent the denizens of the water disport themselves.

The artist or meteorologist sees a faint indication of a cloud in the northern sky, and from curiosity or in the interests of science desires to know something concerning it. He applies to his eye a Nicol prism, and the faint and almost invisible vaporous form stands revealed in all its detail, an exquisite mass of white upon an almost black ground. Nature, especially arborescent nature, presents to its artistic devotee a different appearance when illuminated by a glaring sunshine from what it does when lighted by the clouds of an overcast sky. The Nicol prism converts the former into the latter, removes the reflected sheen from the leaves, and shows their surfaces in their native green color, freed from glitter or glare. "I am satisfied," remarked to the writer the Rev. J. B. Reade, F.R.S., and at that time President of the Royal Microscopic Society of England, "that if photographers were to adjust a Nicol prism in front of their camera lenses much finer effects could be obtained in many cases from the depolarizing of the light reflected from the heads and faces of their sitters." The hint thus given was taken and very fully carried out, so far as regards its application to foliage, with the most surprising and gratifying results.

A visitor to a picture gallery is frequently annoyed by the reflection of the light from the surface of the painting on the canvas, by which he is prohibited from seeing the details of the artist's work unless by shifting his position in an otherwise disadvantageous manner. In the majority of instances the employment of a Nicol prism, by destroying all the false or reflected light, permits of the painting being plainly seen. By placing such a prism in the eyepiece of a telescope, both the luminous intensity and the heat of the solar rays are diminished. As a means of qualitative, or, perhaps more exactly, of discriminative chemical analysis, a pair of prisms when used with the microscope often yield most satisfactory results. The adulteration of nitrate of silver has been discovered from the examination of a crushed sample too small for analysis by chemical tests. Samples of such salts as the iodide and bromide of cadmium have been instantly "located," although these did not exceed half a grain each in weight. Here may be remarked a fact not found in any of the text books of science, that by an aqueous solution of cadmium bromide may be produced the most striking and beautiful crystallizations capable of being obtained for microscopic examination by polarized light. By skillful determination of the heat at which the slide is maintained during the few moments of crystallization, the semblance of vegetation and flowers of the most variegated forms and intense colors may be obtained.

The late Le Neve Foster, Secretary of the Society of Arts, London, has related an application of polarized light which is at least suggestive. A keen amateur photographer, he had practiced this art through the media of dry plates, in the final preparation of which gallic acid played an important part, this acid being of course in solution. On one occasion an exceptional spottiness characterized all his plates, which greatly puzzled himself and his friends to account for. At length a gentleman connected with photographic journalism, and better acquainted than he with the methods of conducting researches into the by-paths of photographic failure, discovered by the aid of the polariscope that the surface of the plate was covered with microscopic particles of gallic acid. Further investigation revealed the cause, which was this: that this acid being more freely soluble in warm than in cold water, a saturated and filtered solution at 80° would at a lower temperature hold in *suspension*, not *solution*, innumerable tiny particles of the acid, which, when applied to the sensitive film in that form, caused the spots complained of. On the more commonly recognized applications of polarized light by the Nicol prism, such as the examination of crystalline minerals, it is not intended now to speak.

Fires in New Jersey Swamps.

The fires which burned in the great Jersey swamps all summer raged until October. Looking across the meadows from the Bergen hills one could see no evidences of fire except the blackened surface and an almost imperceptible blue haze. Yet the fires were there, deep down, seldom developing flames, but steadily burning among the roots and other vegetable matter below the surface. In the daytime, especially when the air was clear and dry, the light blue smoke that rose from the meadows was scarcely perceptible, but at night, when the atmosphere was heavy with moisture, the smoke was held down, and it became thick and spread over the neighboring land, making even the gas jets indistinct and travel out of town troublesome. The Pennsylvania Railroad men said that when a dense fog blew up from the sea it was impossible to see a locomotive headlight a block away. These men say that they experienced more trouble from the fires in Bear Swamp, not far from Princeton, where the marsh was on fire eight or ten feet below the surface.

Proposed Electrical Exhibition in London.

An effort is being made to secure the holding of an International Electrical Exhibition in Crystal Palace, London, in December next. The prospects are said to be good, many of the exhibitors at Paris having agreed to contribute.

ENGINEERING INVENTIONS.

An improved safety valve has been patented by Mr. James W. Young, of Louisville, Ky. The objects of this invention are to obviate the difficulties connected with safety valves of usual form, in respect to limited area of valve opening, failure to open when the maximum pressure is reached, and closing of the valve before the pressure is sufficiently reduced. The invention consists in a steam cylinder and weighted piston combined with a valve or valves hung on a lever, whereby the steam, acting directly upon the piston, opens the valves by moving the lever.

An improved apparatus for amalgamating gold and silver ores has been patented by Mr. Robert A. Nevin, of Silver Cliff, Col. The object of this invention is to make an improved combination of known devices, whereby the ores of the precious metals may be amalgamated at less cost and with greater saving of the metals.

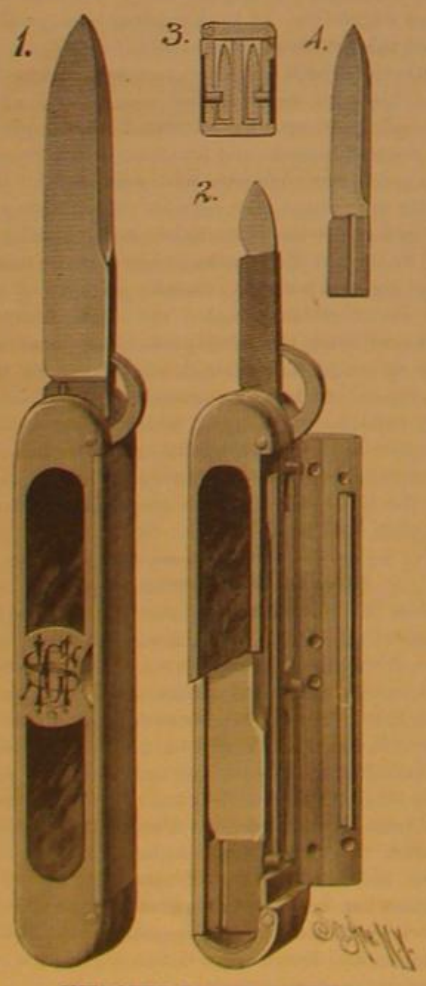
Mr. James Seath, of Terre Haute, Ind., has patented a very useful improvement in car axle boxes. This invention relates to axle boxes for car trucks which have covers sliding in grooves or ways formed on the face of the box, and it consists in a combination with such an axle box, having an inclined front face and a projection at its upper edge, of a cover having its lower edge curved under and forming a lip. This construction prevents the removal of the cover while the parts of the truck are in working position. The cover also is so constructed as to form a tight joint without the use of springs.

IMPROVED POCKET KNIFE.

The engraving shows a knife, the blades of which can be easily removed and others inserted, and which, when not in use, will be convenient and harmless, it being impossible for the blades to open in the pocket, and when in use will be held firm and rigid. The handle consists of a hollow case, open on top and provided with a cover or lid hinged the length of one side, and fitting down upon the top, which is cut out to receive it and allow it, when closed, to lie flush with the ends. A nail notch or socket is provided for opening the lid to be readily opened. The ends of the case are provided with openings of sufficient size to permit the blades to project through them. These blades are contained within the case, which is fitted with partitions as in any ordinary knife. In the lower part of these spaces, on the sides of the case, are the flanges or ribs over which grooves in the heads of the blades fit and slide, thus keeping the edges of the blades from coming in contact with the bottom of the case, and preventing them from falling out when the knife is inverted.

The base or head of the blades on the upper side has the lugs or pins to allow the nail to get hold of and push the blades out. When the blades are in position it is retained by the cover.

In this knife there are no pivots in the blades, which in ordinary knives become loose and render the blades useless. No dirt can get in the knife, and the blades can always be



IMPROVED POCKET KNIFE.

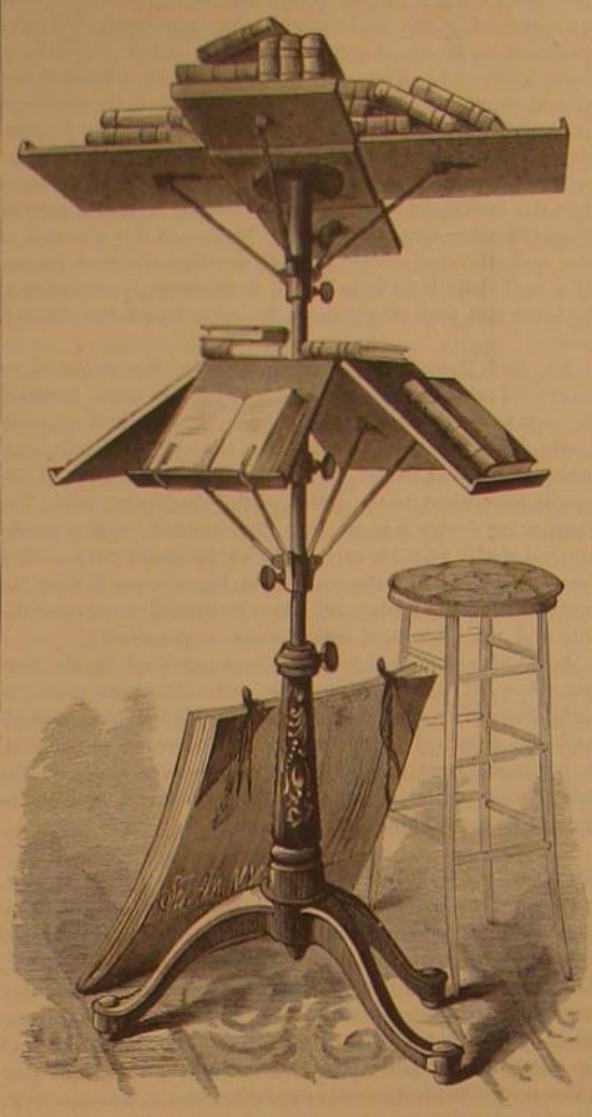
pushed out ready for use, and when worn out or broken can readily be removed and others inserted.

Fig. 1 shows the knife ready for use; Fig. 2 is broken away to show internal parts; Fig. 3 is a transverse section, and Fig. 4 is a detail view of one of the blades

This invention was lately patented by Mr. A. Kayser, of San Francisco, Cal.

IMPROVED BOOK REST.

The engraving shows an improved book rest recently patented by Mr. Joel Swartz, of Camden, N. J. The fixed hollow standard is of iron, and the movable rod which is fitted to it supports one or two tables or rests. In the case illustrated there are two. These rests are each composed of



SWARTZ'S BOOK REST.

four leaves hinged to a central board and supported at any desired inclination by means of the brace rods pivoted to the adjustable sleeve on the standard. Each folding leaf is provided with a spring clip for holding books or papers.

The rest may be turned upon its standard, rendering the device very convenient for office or library use.

On Sulphurous Acid Considered as an Oxidizing Agent.

BY MR. ANTONY GUYARD (HUGO TAMM).

Sulphurous acid is always considered with good reasons, and employed with equally good reasons, as a reducing agent; and although in a well known classical reaction sulphurous acid acts as a powerful oxidizer (namely, by transforming instantaneously the hydrogen of sulphureted hydrogen into water, with deposition of sulphur, as indicated by the formula, $2H_2S+SO_2=2H_2O+3S$), yet this reaction has never been considered as one of combustion or oxidation in the ordinary sense of the term, but rather as a double decomposition.

The writer wishes to call the attention of chemists to the fact, which he has discovered, that sulphurous acid used in the conditions in which it is employed for the reduction from the maximum to an inferior or to the minimum degree of oxidation of metals possessing two or several degrees of oxidation (namely, in the form of solution or of a stream of sulphurous gas passing through solutions of the metal to be reduced) acts also in certain cases as a powerful oxidizing agent, and that this reaction may prove useful to analysis. This is best demonstrated in the following manner:

A solution of protochloride of tin in a moderate state of concentration, such as would be used in the course of an ordinary analysis, is brought to boiling point, and a stream of sulphurous acid gas is passed through it, or a solution of this acid is added to it. After a very few minutes sulphur is deposited, and the whole of the protochloride of tin is transformed into perchloride.

The characteristic action of sulphureted hydrogen on the two chlorides of tin may be brought to play in order to leave no doubt as to the nature of the reaction that has taken place.

The writer feels confident that protochloride of antimony would act in the same manner, and as arsenious acid is not acted upon by sulphurous acid, and as, on the contrary, arsenic acid is reduced to the state of arsenious acid by this substance, the writer expects that these reactions will be applied to analysis in cases in which it would be advisable to possess, in one and the same liquor, arsenic in the minimum and tin and antimony in the maximum state of oxidation.

The reaction of protochloride of tin on solutions of sulphurous acid is thus interesting in itself independently of the interpretation to which it may be subjected; for if, on the one hand, sulphurous acid may be considered as a powerful oxidizer of protochloride of tin, on the other, protochloride of tin may be said to reduce energetically solutions of sulphurous acid.

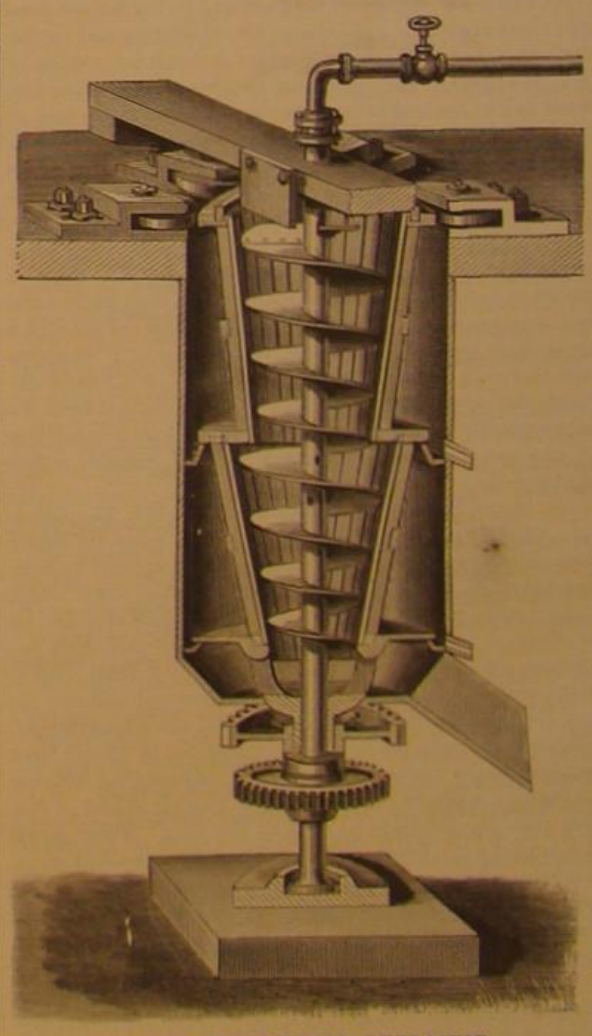
CENTRIFUGAL EXTRACTOR FOR CANE JUICE.

The machine has a vertical shaft with its upper bearing in a box secured to a suitable frame, and its lower bearing in a step secured to the foundation. This shaft is tubular, and its upper end has a stuffing box for admitting the end of a pipe having a stop valve.

The revolving screen consists of substantial ribs of T iron properly bound together and arranged at such a distance apart that there are narrow openings between them. The upper end of the screen is properly secured to a ring placed between rollers, the rollers serving to support the upper end of the screen as it revolves concentric with the shaft. The lower end of the screen rests in and is secured to the ring of a casting connected to the hub of the casting by a number of arms. This screen-supporting casting can turn independently of the shaft, and is driven by differential gearing from the shaft. The revolving screen is placed in a casing having three outlets, two being for the discharge of the extracted juice, the third or lower one being for the escape of waste cane, or bagasse.

In treating sugar cane for the extraction of the saccharine juices, the cane, cut into small lengths, is fed into the top of the screen, and under the influence of the spiral flange of the revolving shaft the cane is fed downward until the whole space within the screen is tightly packed with the cane. As the cane descends it must necessarily be subjected to a continuously increasing pressure, due to the gradual contraction of the upper portion of the screen. The cane, under this pressure, yields its saccharine juices, which, by centrifugal force, are discharged through the spaces between the ribs forming the screen, the juices striking against the interior of the casing and passing from the latter through the outlet into any suitable receptacle. As all the juices may not be extracted from the cane when it has reached the first contraction in the screen, water is discharged from orifices in the tubular shaft at this point, where the screen is enlarged, so that the cane, after passing through the contracted upper portion of the screen, is saturated with water, and the enlargement of the screen permits the mass of cane to expand and absorb this water, after which it is again subjected to gradually increasing pressure, and the water is extracted, carrying with it the juices which it has washed from the cane, the combined water and juices being expelled by centrifugal force and passing through the outlet.

The waste cane, or bagasse, passes from the lower end of the screen between the arms that support the lower ring, and thence through the outlet. The speed of the screen must be determined by the centrifugal force required to dispose of the juices extracted by the pressure due to the spiral



BURGESS' CENTRIFUGAL EXTRACTOR.

flange of the rotating shaft; but there must always be such a difference between the speeds of the screen and that of the shaft that, while the former discharges the juices by centrifugal action, the latter exerts a downward pressure to extract the juices from the cane.

This invention was recently patented by Mr. H. Burgess, of Roger's Ford, Pa.

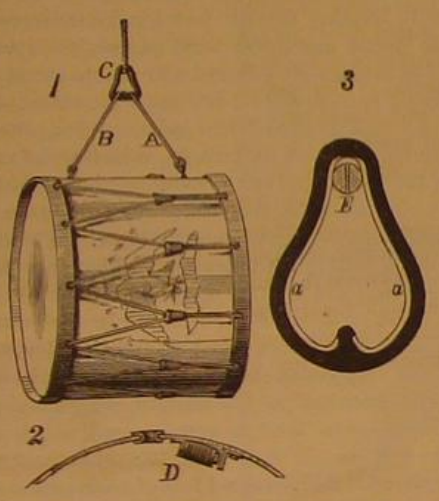
ELECTRICAL MAGIC.

Electricity in its ordinary every-day uses surpasses all the feats of the ancient magi or modern prestidigitators. Sending light, heat, power, signals, and speech to a distance over a wire, the phenomena of induction, the transfer of metals as in electro-metallurgy, and the numerous other uses to which electricity is applied in the arts, are all truly magical and mysterious, since the most profound is unable to assert the true nature of this subtle force.

The application of electricity to magical operations is quite common, but it is capable of more extended and more effective uses.

The few examples shown in the engravings are such as to afford entertainment in the drawing-room and give practice in the applications of electricity.

The mysterious drum, shown in Figs. 1, 2, and 3, has been constructed in various forms. It is designed to beat by means invisible and undiscoverable without removing the drum heads. The drum is suspended from what appears to be an ordinary hook, and the operative parts are concealed so as to be invisible either through the translucent heads or through the embouchure. The drum is suspended from the ring, C, by chains, A B, or by straps concealing metallic wires. The screw-rings extending through the body of the drum communicate electrically with the magnet, D, which is placed so near the embouchure as to be incapable of being seen through it. The armature of the magnet is supported very near its poles by an angle plate rigidly secured to the body of the drum, as shown in Fig. 2. The chains, A B, touch metallic contact pieces, *a a*, embedded in the inner surface of the ring, C, which may be either wood or rubber (Fig. 3). These contact pieces at their upper ends touch on opposite sides of the hook, E. This hook is divided vertically into two parts throughout its length, the two portions being separated by a thin piece of mica and bound together by a hard rubber knob at the outer end, and hard rubber ring or base-piece near the end inserted in the wall. The two halves of the hook are connected with battery wires leading to some distant point, and an interrupter worked by hand or clockwork is put in the electrical circuit. A wheel, notched



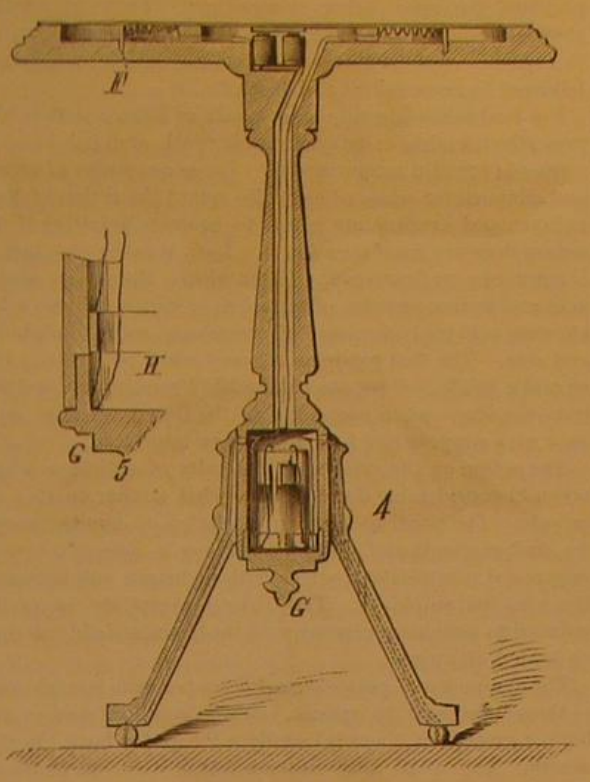
MYSTERIOUS DRUM.

according to the kind of call required, attached to the revolving spindle of a spring motor and touched by a contact spring, makes a good interrupter for this purpose.

This device is puzzling to the uninitiated, as it is impossible to see how the results are obtained without dismembering the apparatus. By means of a spur in each heel, and wires extending under the garments to the hands, it is possible to transfer the drum from its hook to the finger and secure the same results, provided two long conducting plates or strips, to be touched by the spurs, are placed beneath the carpet, and connected with the battery and interrupter. The removal of the drum from the hook to the finger adds another element of mystery to the device.

Much that cannot be otherwise satisfactorily explained is charged to the supernatural. The phenomenal sounds said to be evoked from tables by the weird inhabitants of the spirit world may be very successfully imitated by means of simple electrical contrivance shown in Figs. 4 and 5, and not only may the raps be produced, but sepulchral voices may be heard from the face of the table.

The table-top consists of two parts, the thicker portion being hollowed out, so as to form a circular cavity in the middle, surrounded by an annular cavity. The whole is covered with a top about one-eighth of an inch thick. The table standard is hollow, and chambered out sufficiently at the lower end to receive a compactly made Leclanché battery, which rests in the cap, G, fitted to the lower end of the standard. From the battery two wires extend to springs in the cap, G, and these springs touch two semicircular pieces, H, of metal attached to the inner surface of the chamber containing the battery (see Fig. 5), so that when the battery is in place, one of its conductors will touch one of the pieces of metal, and the other spring will touch the other piece. The two semicircular pieces of metal are connected with two wires extending upward through the table standard, one wire being connected with a serrated metallic hoop, F, placed in the annular space in the table-top; the other wire is connected with one terminal of an electro-magnet whose other terminal is connected with a flat metallic ring attached to the thin portion of the table-top and located immediately above and very near the serrated hoop, F, but not touching it. Now, by placing the hand flat upon that part of the thin cover of the annular space in the thicker portion of the table-top and pressing so as to spring the cover ever so little, the electrical circuit is closed and the electro-magnet draws down the armature which is attached to the thin



RAPPING AND TALKING TABLE.

table-top near the poles of the magnet, but not touching them. This makes a loud rap, and when the electrical circuit is broken by removing the pressure, a similar rap is produced. The movement of the hand in this operation is imperceptible.

From each of the wires extending upward in the standard, a wire extends down one of the table legs, and terminates in a single point, having sufficient length to pass through a carpet and touch two plates of metal communicating with a transmitting telephone or with a telegraph key and battery. With the former the table answers as a receiving telephone, and the magnet will be more efficient for this purpose if it be polarized. When the key is used, the raps may be produced by some one operating the key at a point remote from the table. In either case a confederate is required.

By placing conductors under the carpet at different points, the table may be moved about to enhance the delusion.

Figures 6 and 7 show insects that appear to be animated when disturbed, and as they are similar in construction, the description of one will answer for both. The pot containing the plants upon which the insects are mounted is broken away in the engraving, to show the interior, and the dragon-fly is shown in section in Figure 7. This is nothing more nor less than a vibrator-interrupter, made in the form of a dragon-fly, with mica wings attached to the vibratory spring and striped with asphaltum varnish, in imitation of nature.

The body of the fly consists of an iron wire wrapped for a part of its length with No. 24 silk-covered wire, forming a small electro-magnet, whose armature, *b*, is attached to a spring forming a part of the back, and fastened at *c* to the wire forming the core of the magnet by means of binding wire and jeweler's cement, or sealing wax. One terminal of the magnet wire communicates through one of the legs of

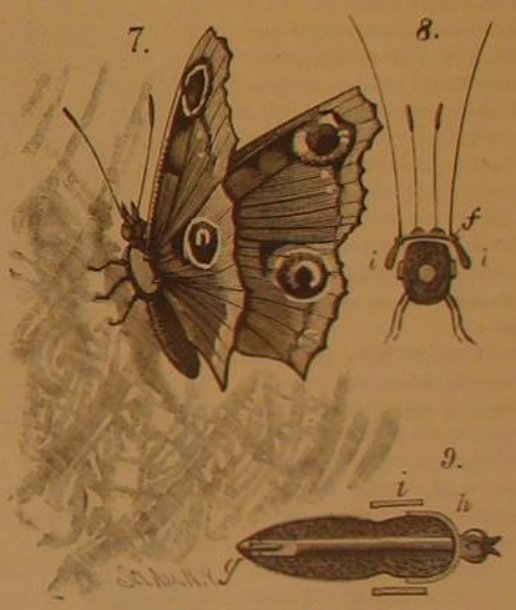
ELECTRICAL DRAGON FLY.

the fly with a wire running through the stalk of the plant to the carbon pole of a small Leclanché battery concealed in the flower pot. The other terminal of the magnet wire is connected with the vibrator spring at *c*. The free end of the vibrator spring extends from the armature, *b*, downward, and is provided with a platinum contact screw, *d*, which touches the contact spring, *e*, the latter being in electrical communication with a button on the under side of the flower pot cover, which is touched by a spring attached to the side of the pot. This spring is connected with a wire that extends downward and terminates in several points disposed about a circle concentric with the bottom of the pot. The zinc pole of the battery is provided with a wire having several terminal points alternating with the points previously mentioned. The bottom of the pot is slightly concave, and contains a small quantity of mercury, which, in consequence of its great mobility, completes the electrical current between some of the wire terminals in the bottom of the pot when the latter is taken in the hand and moved ever so little.

The battery is of small size, the jar consisting of a common tumbler. When the device is taken in the hand, the wings, which are attached to the vibrator, spring immediately, tremble and buzz in true insect fashion. If the plants and insects are firmly made, they are sure to be taken in the hand for examination, when the latter will exhibit signs of life.

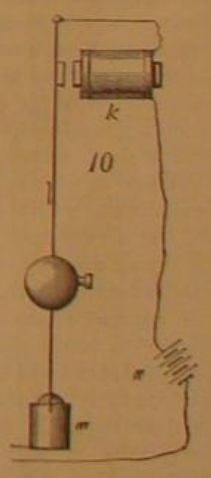
The butterfly shown in perspective in Figure 7, and in transverse and longitudinal section in Figures 8 and 9 respectively, is intended to be placed upon lace curtains or on a picture frame. The body, as in the case of the dragon-fly, consists of an electro-magnet having its polar extremity, *h*, returned upon the magnet wire. The back of the butterfly consists of an iron shell swaged into the proper form and attached to the smaller end of the magnet by means of a screw, *g*. To this shell are pivoted on delicate pivots, *f*, two small armatures, *i*, which extend downward over the returned pole extension of the magnet. These armatures carry the natural wings of a butterfly, and as the pulsating electrical current runs through the magnet the wings are vibrated in accordance with the intervals of open and closed circuit.

The electrical impulses may be controlled by hand or by



ELECTRICAL BUTTERFLY.

clockwork, or by means of an electric pendulum interrupter, shown in Figure 9. The current which passes from the battery, *n*, through the butterfly, passes also through the magnet, *k*, of the interrupter through the pendulum rod, *l*, and through the mercury contact cup, *m*. When the pendulum is drawn toward the magnet the circuit is broken; when the pendulum is released the circuit is instantly closed, and the pendulum is drawn forward again. The electrical pulsations produced in this way move the wings of the butterfly more or less rapidly according to the length of the pendulum.



Current Breaker.

Three or four of these butterflies may be controlled by a single pendulum. These objects placed on a lace curtain are amusing and make very pretty ornaments.

The fine wire forming the conductor may be white cotton covered, which may be easily concealed in a lace curtain.

Fast Work in Cloth Making.

Governor's day at the Atlanta Exposition was signalized by the manufacture of two complete suits of clothes from growing cotton, all the processes being finished within twelve hours. A large crowd watched the skillful workmen. The gathering, ginning, picking, carding, spinning, weaving, and dyeing were successively completed with great rapidity and perfection, and at 12:55 o'clock in the afternoon the cloth went to the tailor. That evening at 7 o'clock Governor Bigelow, of Connecticut, arrayed in one of the suits, was receiving a delegation from the Atlanta University at the residence of Director General Kimball, while in the other Governor Colquitt was submitting himself to admiration at the Executive Mansion.

Poisons and their Antidotes.

Under the head of poison may be classed any substance—gas, liquid, or solid—which by its own inherent qualities is capable of injuring health or destroying life.

As a rule poisons prove most rapidly fatal when introduced, by a wound in a vein or by hypodermic injection, directly into the blood. Their action is also speedy when brought into contact with the membrane of the lungs. They are, as a rule, readily absorbed through the serous and mucous membranes of the body, while through the skin the absorption is slow.

When taken into the stomach, poisons—especially if liquid—act more speedily when the latter is empty than when it is full.

Most poisons injuriously affect the system, no matter how introduced into it, but there are exceptions to this rule—the sting of the viper may be deadly, but the poison is harmless when swallowed. There are also a class of bodies which when swallowed most directly affect the nervous system, but fail to act when applied to the brain or nerve trunks.

Some poisons disorganize or corrode the organs with which they come in contact, but there are many—especially among the narcotics—that, while producing very slight local change, often develop remarkable remote effects. Belladonna, in whatever way introduced into the system, paralyzes the ciliary nerves, and so causes dilatation of the pupil.

The preparations of arsenic, opium, and the prussiates (cyanides) are the substances most frequently employed as poisons in this country. The symptoms attending slow poisoning by arsenical and antimonial compounds are frequently such as might appear to be owing to natural causes, and it is to be feared that more instances of secret murder due to such causes have occurred than have been detected.

The following is a condensed statement of the characteristics, symptoms, antidotes, and simple methods of testing for and identifying some of the more common poisons:

Poisons are usually divided into three classes—irritant, narcotic, and narcotic-irritant. Irritant poisons are usually considered under the heads of mineral—or metallic and non-metallic—irritants, vegetable irritants, and animal irritants. In the first of these divisions is arsenic and its compounds—arsenious acid (white arsenic), metallic arsenic, fly powder, potassium arsenite (Fowler's solution), arsenic acid, arsenic sulphides (yellow orpiment and red realgar), arsenical pastes, soaps, etc. This fearful poison has of late years caused more untimely deaths than any other mineral poison. Some of the insoluble compounds of arsenic are not so rapid in their action upon the system as the more soluble ones, but there is not a single compound into which arsenic enters that is not capable of causing fatal results when taken into the system.

From half an hour to an hour after the arsenic has been swallowed the person begins to feel a nameless uneasiness, developing into faintness, depression, and nausea, with an intense burning pain in the region of the stomach, increased by pressure, retching, vomiting, sense of constriction in the throat, with intense thirst; diarrhea, more or less violent, accompanied by cramps in the calves of the legs; matter discharged from the stomach of a dark greenish color, sometimes streaked with blood. The pulse becomes small, frequent, and irregular; skin cold and clammy in the state of collapse, at other times very hot; respiration painful; eyes red and bright. Sometimes the sufferer becomes unconscious or suffers partial paralysis or tetanic convulsions—precursors of death. These symptoms will vary according to the nature of the compound and the quantity taken.

There is no *specific* antidote for arsenic, and remedies are rarely attended with success if not applied at an early stage. Mixtures of olive oil and lime water promptly administered after the effectual use of an emetic have been recommended; recently precipitated hydrated oxide of iron mixed with magnesia has also been used with favorable results. No chemical antidote should ever supersede active evacuent treatment by emetics and with the stomach pump.

To test a suspected liquid or powder for arsenic, mix it with a small quantity of pure dilute hydrochloric acid, heat nearly to boiling, filter, and pass through the nearly neutral liquid a stream of washed hydrogen sulphide gas. If arsenic is present a lemon-yellow precipitate or yellow cloudiness (arsenic sulphide) will be formed, and will subside after boiling or exposure to the atmosphere. The presence of much animal or vegetable matters may change the yellow to a brown tint.

In Reinsch's test the substance is boiled with about one-sixth part of pure hydrochloric acid and a slip of bright, clean copper wire or foil placed in the solution. If arsenic is present the copper quickly acquires a dark iron-gray color. When this is washed, dried, and heated in a reduction tube the coating is converted into white arsenious acid, which sublimes in minute octahedral crystals. With Marsh's process very minute quantities of arsenic can be detected in a substance, but in the hands of an amateur the experiment is very apt to terminate in an explosion.

Lead or its salts are often taken into the system unawares—in drinking water which has been allowed to stand in lead pipes or reservoirs, or in preserved vegetables and fruit cooked or allowed to stand for a long time in contact with lead soldered joints. All lead salts are more or less poisonous, and their effects are accumulative—as with the painter who becomes "leaded" by the gradual absorption of lead from the paints with which he is in constant contact. When any considerable quantity of this metal has been swallowed or when it has accumulated in the system the usual symptoms are: a burning, prickling sensation in the throat, with dryness and thirst, uneasiness of the stomach, and irritation of the alimentary canal, followed by violent and obstinate colic and great pain in the abdomen, relieved somewhat by pressure, the pain being intermittent. There is usually obstinate constipation, cold skin, and general prostration. In extreme cases the extremities become numb or paralyzed, followed by convulsions and insensibility.

For lead poisoning sulphate of soda or Epsom salts is the prescribed antidote; powdered charcoal and sulphate of magnesia are also recommended. Large quantities of cream and albumen (or white of egg) also retard the action of lead poisons, and emetics are given to promote vomiting if the poison does not itself occasion it. Lead is easily detected in a substance by heating the latter with a little pure acetic acid and testing samples of the solution with sulphuric acid, chromic acid (or bichromate of potassium), sodium sulphide, and zinc. The first produces a heavy white precipitate, the second a bright yellow, the third a black precipitate, and the last—the zinc—when suspended in the liquid becomes covered with a crystalline formation of metallic lead.

The action on the system of the salts of antimony when taken in considerable doses is somewhat similar to that of arsenic. The usual antidotes are solution of tannin, strong tea, and magnesia and milk. Antimony is detected by the orange-red precipitate it gives with hydrogen sulphide and the alkaline sulphides. The dried precipitate is easily reduced to metallic antimony with the characteristic reaction on heated charcoal.

The symptoms of poisoning with copper salts are similar to those produced by arsenic, but the vomited matters are blue or green, and there is usually a "coppery taste" in the mouth. The usual antidotes are warm water to promote vomiting, white of eggs, strong tea or tannin solutions, and weak solutions of protosulphate of iron or potassium ferrocyanide in water. Copper in solution is detected by the blue color it forms with ammonia when the latter is added in slight excess, and by the brownish-red precipitate which forms on the addition of solution of potassium ferrocyanide. Most of the salts of copper have a clear blue or green color, easily recognizable.

Salts or preparations containing mercury in any form—corrosive sublimate, white precipitate, black oxide, red precipitate, mercuric iodide, vermilion, mercuric sulphate, mercuric ointments, etc.—are extremely poisonous. A few minutes after swallowing any of these a "coppery" taste is observed, followed by a sense of constriction in the throat and irritation of the throat and stomach. Nausea and vomiting soon occur, the vomited matter consisting of coagulated mucus and blood. Diarrhea follows, and the face of the patient becomes swollen and alternately flushed and pale. The pulse becomes small and irregular, the skin clammy, and respiration labored. In extreme cases the interior of the lips become swollen, and the tongue white and shriveled. The case frequently terminates with syncope, convulsions, or general insensibility. Egg albumen administered with warm water to allay the irritation and produce vomiting is the usual antidote. Milk and gluten or flour is also recommended. Active efforts should at once be made to effect the entire expulsion of the contents of the stomach. The stomach pump cannot be used.

The operation of such narcotic poisons as opium and prussic acid or prussiate of potash (hydrocyanic acid or potassium cyanide) is confined chiefly to the spinal marrow and brain.

The effects of hydrocyanic acid (and potassium or other similar cyanide) are almost instantaneous; it is very rarely the case that they are delayed more than two or three minutes. On the other hand, cases of fatal poisoning by opium do not terminate earlier than from six to twelve hours.

In cases of poisoning by cyanides emetics and the stomach pump are at once called into requisition. Freshly precipitated hydro-iron oxide, if administered immediately, is perhaps one of the best antidotes. Chlorine water injected into the stomach is also recommended.

Nitrate of silver yields with solution of the soluble cyanides a white precipitate. When a few drops of a solution of potash in gum water is mixed with a small sample of the suspected liquid and solution of sulphate of iron is then added a dark brown precipitate separates in a few minutes. This precipitate, when agitated with sulphuric acid, develops a deep blue color if cyanides were present.

These are only a few of the long list of active poisons, but they include those which are in nine cases out of ten responsible for the fearful record of poisoning cases. And it is assuredly true that but for the want of a little timely and definite knowledge respecting common poisons and their antidotes—such as we have endeavored to briefly sketch above—the list of fatalities from poisoning might have been shortened one-third.

Diamonds and Other Mineral Products of South Africa.

The diamond industry in South Africa continues to be exceedingly productive. The gross weight of diamonds sent through the Kimberley post office last year was 1,440 pounds avoirdupois, valued at nearly $17,000,000. According to the Manchester *Courier*, the annual value is estimated as follows: Kimberley, £4,000,000; Old de Beer's, £2,000,000; Du Toit's Pan, £2,000,000; Bultfontein, £1,500,000. At the end of last year 22,000 black and 1,700 white men were employed at these mines. From the Kimberley and Old de Beer's mines alone diamonds to the extent of 3,200,000 carats are annually raised, while the other two mines above named yielded 300,000 carats last year. At the diggings on the Vaal River about 250 men were at work last year. The other important mining industries of the colony are the copper mines of Namaqualand, from which last year 15,310 tons of copper were exported, valued at £306,790. From the manganese mines in the Paarl division 206 tons were exported; while at the coal mines in the Wodehouse and Albert divisions about 1,000 were raised. The salt pans in Simon's Town, Malmesbury, Piquetberg, Fraserberg, Uitenhage, and Cradock, yielded about 9,000 tons of salt. Mineral springs abound in the colony, many of them being well resorted to, but accommodation for visitors is, as a rule, indifferent.

Casting and Moulding in Brass and Bronze.

The methods of technical instruction abroad are indicated in the following brief extract from a foreign journal regarding the Bavarian Technical Museum at Nuremberg. This institution possesses a foundry built on the French plan in imitation of that of Barbedienne in Paris. The tools and material employed are the same as those in use in Paris, for it is conceded that France leads in casting works of art in brass and bronze.

The material used for the mould is a mixture of two parts of yellow sand with one of black. The former is sand from Fontenay-aux-Roses, near Paris. The latter is from moulds that have been used, and is prepared by breaking them up and sifting them. To impart to this moulding sand the necessary fineness and consistency it is moistened with water and run through a sand mill twenty or twenty-five times. For economical reasons this carefully prepared sand is not used to fill the whole flask, but only a rather thin layer is placed next to the pattern. The moulding flasks are wrought iron frames, ribbed inside to secure the mass of sand, and so fixed that they always have the same position in regard to each other.

In moulding they begin by filling one frame on the moulding board with coarse black sand and ramming it down, then the pattern or model is embedded in it, generally to the middle. Then the freely exposed half of the pattern is covered with the prepared moulding sand, which is prevented from adhering to it by dusting it with powdered soapstone. To prevent the upper and lower sand masses from adhering the surfaces in contact are covered with potato starch. The fine sand having been pressed down upon the model, one-half of the casting flask is placed over and around it. The fine sand that is in contact with the pattern, as well as the exposed portions of the black sand on the moulding board, is dusted with potato flour, and then the flask is packed with coarse black sand firmly stamped and pounded down. When this half of the flask is lifted up the black sand which was thus packed in adheres to it and is lifted up with it. The whole is turned over and laid on a board. The core pieces are taken up in inverse order, the pattern lifted up and placed with the cores, etc., in the impression left in the black sand of the other half. The other half of the pattern, which was previously embedded in coarse sand, is now exposed, and is moulded as the other half was in fine sand, the other half of the flask placed around it and stamped full of coarse sand as before.

Before moulding the other half the channels are cut for pouring in the metal, as well as the escape holes for air and gases, and are one-half in the upper and half in the lower part. When both halves are filled and stamped the mould is opened and the pattern taken out, and the mould dusted with extremely fine argillaceous sand, then with talc powder. The pattern is then put in again, and the mould closed and gently hammered. This gives the mould greater smoothness and fineness. Finally, the pattern is taken out, and the mould painted over with a mixture of English red, charcoal powder, and water, so it may offer greater resistance to the inflowing metal, especially in the fine ornaments.

As soon as this is dry it is painted over with a vegetable oil, which makes the sand easy to remove from the casting, while it imparts to the surface of the latter a fine dark color. It is now ready for drying. The two halves are separated and put in the drying oven, where they are left twenty-four hours. On taking them out they are smoked with a pitch torch and then put in the casting press. The moulds are placed inclined, so that the casting holes are upward. The casting is done directly from the crucible in which the metal or alloy is melted.

Castings made by the process above described are massive. If they are to be hollow with a core inside, which is frequently done in small articles and always for large ones, the core is made inside of the mould. The material for the core consists of rather more black sand than for the mould, and is not worked so fine. It is exclusively made by pressing the core sand in the mould, since this is so firm, owing to the excellent quality of the moulding sand, that it is not injured thereby. The core is afterward trimmed around to make it enough smaller to allow for the thickness of the casting. Of course this has to be supported so as to leave the proper space empty around it. For this purpose wires are inserted in the cores and rest on the sand outside of the impression of the mould. Beside the wires one or more sheet iron or tin tubes with perforated walls are stuck in the cores and serve to carry off the air and gases.

The castings made as above in the foundry of the Bavarian Museum, it is said, are not inferior to the French, and the process has been successfully introduced into several Bavarian establishments by pupils of the Nuremberg school. This is carrying out the practical idea of technical fine art in education in a manner worthy of imitation and with a success not to be despised. P. N.

The Brotherhood of Locomotive Engineers.

At the morning session of the International Brotherhood of Locomotive Engineers, in Baltimore, October 22, the annual election of officers took place, and Chief Engineer Arthur holds over until 1883. Mr. T. S. Ingraham, of Cleveland, was unanimously re-elected First Grand Engineer for three years; Robert Thomas, of St. Thomas, Ontario, Canada, Second Grand Engineer for one year; and E. A. Stevens, of Boston, Second Grand Assistant Engineer.

THE SPOTTED AMBLYSTOME.

C. FEW SEISS.

This brilliantly marked amblystome was first described by Linnæus, in 1767, under the name of *Lacerta punctata*, that is, dotted lizard. But in 1803, Barton, in "Daudin's History of Reptiles," renamed it the *Salamandra venenosa*, or venomous salamander. Barton subsequently burdened it with another specific name, *subviolacea*, which was adopted by several naturalists; but the law of priority forces us to reject all except that of Linnæus, namely, *punctata*. We of course know that our animal is not a lizard. It does not even belong to the class of reptiles. But although Linnæus' classification and nomenclature were admirable in their time, they are now totally inadequate to embrace the vast kingdom of nature, so great has been the investigations and advancement of science.

For what reason Barton called it venomous we are at a loss to know, unless he was so informed by ignorant persons, and without testing the truth of the assertion, so published it to the world. It is hardly necessary for me to say that this amblystome, and in fact all of the salamander family, are non-venomous and harmless.

The salamanders are interesting on account of the wonderful metamorphoses they undergo. Thus, during the first part of their lives, they breathe by gills alone, and then are closely related to the fishes; and, in the latter part, breathe by lungs, and then in many points resemble the higher animals. The evolutionist, therefore, looks to this quarter for the link between the fishes and the mammals.

The spotted amblystome, *Amblystoma punctatum* (Linnæus), Baird, is of a coal-black color above, and dull purple gray beneath. On each side of the dorsal line is a series of large round lemon-yellow spots. These spots are about the size of the eye or a little larger, and number generally eight or ten from the head to the hind limbs. On the sides and abdomen are scattered small bluish-white dots. There are a few yellow spots and whitish dots on the legs. There is a strong groove or furrow along the back from the head to the base of the tail. In alcohol the spots become white, and the animal is not so pretty as in life. Its average length is six inches, but it frequently attains the size of six and a half inches and more. It can be distinguished from the tiger amblystome (*A. tigrinum*), to which it bears a slight resemblance, by its strong dorsal groove, and in having two rows of yellow spots, while in *tigrinum* there are many and irregular. It is found under rotten logs and bark in moist woods and forests, from Canada to Louisiana, and west to Missouri.

THE SPOTTED AMBLYSTOME.—(*Amblystoma punctatum.*)

Extraction of Tannin.

Mr. O. Kohlrausch has succeeded in devising a process of extracting tannin in almost theoretical quantities from many different kinds of barks. He concludes that as in tannin the tannic acid (tannin) enters the skin by osmosis, it similarly leaves the cells of plants through their permeable membrane; chemical and microscopical examination having shown that the interior of the uninjured cells is the same as the exterior of thick bark which had already been utilized. It is therefore not the solution of the tannin set free by finely dividing the bark, and taken up by the skins, *but dialysis of the tannin through the permeable membrane* of the plant cells, and also through the animal membrane of the skin.

Hence it is not necessary to divide the bark into very small fragments, but, on the contrary, pieces may be used with advantage which are small enough to allow the dialyzing operation to take place in a battery of closed vessels, thus avoiding any danger of choking up the valves or pipes of the apparatus.

The result of this is that purer extracts are obtained in a more economical manner, so that lighter colored extracts rich in tannin can be prepared at a smaller cost than usual, and in the case of tannin lighter colored leather is produced. In the latter circumstance the author is of opinion that if the freshly prepared dialyzed extracts are used at once considerably less tannin would be required.

The researches of the author have shown that *tannin passes through the animal membrane very rapidly in the dialyzer*, so that in a short interval of time fine extracts run from a battery, and the residual bark is almost entirely free from tannic acid. It appears from this curious result that tannin must be a *crystalloid*, although it has never been obtained in a crystalline state in the laboratory.

The Vegetable Origin of Diphtheria.

In a recent lecture before the Academy of Natural Science, in Philadelphia, Prof. H. C. Wood, of that city, gave a statement of the results of certain researches upon the nature of diphtheria undertaken by him and Dr. H. F. Formad, at the instigation of the National Board of Health. The investigations embraced not only the ordinary endemic diphtheria prevailing in Philadelphia, but also the more violent forms of the disease occurring from time to time in different places.

In this pursuit Dr. Formad visited an infected town on Lake Michigan, where one-third of all the children in a marshy district died of the epidemic, and brought back with him specimens of the diphtheric virus, several of the false membranes which are invariably formed in the throats of afflicted persons, and portions of their viscera. In all blood, said the professor, as reported by the Philadelphia *Times*, there are two kinds of corpuscles, the red or color-giving and the white. By careful study and experiments, both in human beings and the lower animals, it was found that this infinitesimal plant fastens upon the white corpuscles and multiplies its cells, altering their character until, with the interior destroyed, they burst, and the plants, set loose in an irregular mass, separate and go off individually, to continue the destructive work on other corpuscles. Thus increased, they poison the blood, choke the vessels, and are found in myriad numbers in the spleen and other organs rich in blood. Prof. Wood's investigations show that the false membrane, supposed to invariably indicate the presence of diphtheria, may be caused by ammonia, Spanish fly, or any other irritating influence in the throat, so that its presence is not infallible as indicating the existence of this disease.

But in any case the false membrane is built up by this parasitical plant, which grows and multiplies upon its inflamed surroundings, whatever may be its cause. It is when the plants grow strong enough to extend to the blood, either poisoning it themselves or carrying the poison with them, that diphtheria sets in. This little plant is exactly the same as found upon the coated tongue. When Prof. Wood put plants such as are found upon a healthy tongue in sterilized matter they failed to grow. On the contrary, plants from the throat or blood of a person affected with diphtheria multiplied rapidly. The practical result of the investigation pointed out was the possibility that diphtheria, if existing theories hold good, may be prevented by artificial vaccination.

In the case of splenic fever caught from animals, which has been proved to originate in a somewhat similar plant, Pasteur has found that the plant, when exposed a sufficient time to the air, by the action of oxygen loses its virulent character, and when then introduced into the system makes the animal sick, but is no longer fatal. The deduction is that this diphtheric plant, scientifically known as "micrococcus," may in time be cultivated so that when inoculated with it the system will be no longer subject to the disease in its fatal form. Concluding the lecture, Prof. Wood was applauded when he said that these discoveries could never have been made but for the aid of vivisection, against which there is a foolish prejudice in the minds of many.

Choice of Seed in Cotton Growing

A Mississippi planter has on exhibition at the Atlanta Cotton Fair a bale of cotton, pronounced by many good judges as the finest short staple cotton ever seen in Atlanta. His especial hobby is the selection of his seed. It is not a question of different varieties, but of good and bad seed of the common variety. He has the seed of his best stalks selected every year for planting; and he claims that it is by a judicious selection of seed that the cotton can be made better. It is needless to say, remarks a critical observer, that as a rule the selection of seed and of guano, as well as the methods of culture, are matters of accident and not of exact study. There is no reason why the greater part of the inferior cotton that sells for eight or nine cents might not, under a careful system of agriculture and manipulation, be made to sell for ten or twelve cents. Careful agriculture, if need be scientific agriculture—this is what the South needs quite as much as manufactures and capital. These samples of cotton are not a very great attraction to the Southern farmers that visit the exhibition, but the lessons that are to be learned from the experiments that have produced them are the most important lessons by all odds that the exhibition can teach.

Soles and Turbots in New York Waters.

The United States Fish Commission lately received from England three live soles and six turbots out of a consignment of seventy soles and thirty-five turbots. The fish were set free off Coney Island. Previous attempts to transplant these fish to American waters have not been successful.

The turbot is a soft-rayed flat fish, whose left side is of a brownish color and under or right side white. Without the tail its body is almost round. The common size of the fish varies from five pounds to ten pounds weight, although occasionally it attains to twenty pounds and sometimes thirty pounds. It is the most prolific fish known. One weighing twenty-three pounds was once found to contain a roe weighing five pounds nine ounces, which contained 14,311,200 eggs. The majority of turbot are taken along the east coast of England and the coast of Holland. It is caught in trawl nets and also on lines, the most taking bait being those fishes of bright color. The sole is also a soft-rayed flat fish, which, to the casual eye, somewhat resembles the flounder. Its length varies from ten to twenty inches. Its color is a uniform dark brown above and a white below, the pectoral being tipped with black. To the British public soles are the most important of all sea fishes. Little is known of their habits. They are caught in great quantities off the coast of England, in the North Sea, where they breed. Both fishes are considered great delicacies in England.

Carrier Pigeons as Doctors' Messengers.

The *Medical Record* has the following: A physician of Erie, Pa., is training homing pigeons for use in his practice. Some of his young birds, put upon the road to make records for distance, have made very good time, namely, fifty miles in ninety minutes, sixty-six miles in eighty-two minutes. Homing pigeons are largely used by country physicians, both here and abroad. One doctor in Hamilton county, N. Y., uses them constantly in his practice, extending over nearly two townships, and considers them an almost invaluable aid. After visiting a patient he sends the necessary prescription to his dispensary by pigeon; also any other advice or instruction the case or situation may demand. He frequently also leaves pigeons at places from which he wishes reports of progress to be dispatched at specified times, or at certain crises. He says he is enabled to attend to a third more business at least through the time saved to him by the use of pigeons. In critical cases he is able to keep posted by hourly bulletins from the bedside between daylight and nightfall, and he can recall case after case where lives have been saved that must have been lost if he had been obliged to depend upon ordinary means of conveying information.

BUFFON spoke wisely when he said: "How much useful knowledge is lost by the scattered forms in which it is ushered to the world! How many solitary students spend half their lives in making discoveries which had been perfected a century before their time, for want of a condensed exhibition of what is known!" This want is met by the SCIENTIFIC AMERICAN, and our notices of new inventions alone are worth many times the cost of the paper to inventors and others, with whom it is more than ordinarily important to know not only what is doing but what has been done.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

Correspondents sending samples of minerals, etc., for examination should be careful to distinctly mark or label their specimens so as to avoid error in their identification.

(1) Miss A. S. B. asks: 1. At what temperature and under what pressure do oxygen and hydrogen gases liquefy? A. According to the experiments of M. Pictet, oxygen liquefies at a temperature of —292° Fah., under a pressure of about two tons per square inch, or at —220°, under a pressure of 3,780 pounds per inch. At a temperature of —230° Fah., hydrogen requires a pressure of 9,780 pounds per square inch to liquefy it. 2. Have these gases, or air, been solidified? A. Yes. In Pictet's experiments the solidification of particles of these substances was made apparent by the peculiar sound of the liquefied gas as it issued from the tubes when the valves were opened, the particles striking the floor with a noise like fine hail. The electric light thrown on the jets showed bright central cores of solid matter.

(2) A. H. asks: Is there any way of removing rust from the wrapping of hoop in skirts? A. We know of no practical way.

(3) E. M. says: Please give a good receipt for a liquid shoe polish. A. Dissolve in a half pint of soft water three-eighths of an ounce of potassium bichromate, and add six ounces of logwood extract dissolved in one gallon of warm water. Dissolve in one gallon of water by continued boiling six ounces borax and one and a half ounces of shellac. Mix all together while warm, and add three ounces of aqua-ammonia. Apply with a brush.

(4) C. E. asks: Can you inform me what the ingredients and proportions are of printer's ink and how to make it? Also, how to make aniline ink dry quickly? What driers are usually used? A. See Printing Inks, page 400, No. 26, vol. xliv.

(5) J. J. asks: Can you give me a recipe for bleaching dark hair to light or golden tinge—that is the so-called golden fluid which is sold at perfumers' shops? A. One of the "golden fluids" sold for this purpose consists of an aqueous solution of bisulphite of soda, prepared by passing a current of sulphurous acid gas, generated by the action of hot oil of vitriol on copper scraps, into a saturated aqueous solution of carbonate of soda until the liquid will absorb no more of the gas. Another bleaching agent used for the hair is a dilute aqueous solution of peroxide of hydrogen.

(6) T. B. S. asks: 1. What are the old and the new formula of common potash alum? A. Old—$KOSO_3+Al_2O_3 3SO_3+24HO$; new—$K_2Al_2 4SO_4.24H_2O$. 2. What is the formula, according to the new system, of ammonia alum? A. $(NH_4)_2Al_2 4SO_4+Aq$. 3. What per cent of sugar does the sugar beet yield (in practice)? A. About 8 per cent.

(7) R. G. C. asks: Will creosote preserve wood from the teredo, and how long? A. When well impregnated with creosote or dead oil wood is safe against the attacks of insects under ordinary circumstances.

(8) I. McP. asks: Which kind of sumac is it that is used for tanning, dyeing, etc.? A. *Rhus coriaria*, which closely resembles our common staghorn sumac (*Rhus typhina*), is most in demand; but the stagshorn and other similar varieties of sumac are nearly as valuable as the *R. c.*

(9) A. K. asks: 1. How can I gold plate small articles? I have a few rings and cuff buttons which I would like to plate without a battery. A. Digest a small fragment of gold with about ten times its weight of mercury until it is dissolved, shake the amalgam together in a bottle, and after cleansing the articles coat them uniformly with the amalgam. Then expose them on an iron tray heated to low redness for a few minutes—the mercury volatilizes, leaving the gold attached as a thin coating to the article. The heating should be done in a stove, so that the poisonous mercurial fumes may pass up the chimney. See Gold Deposits, page 116, vol. xliv. 2. Could a battery be attached to a small velocipede so as to propel it without going to much trouble or expense? If so, what kind of a battery would be best? A. It is impracticable.

(10) E. A. W. asks: Do you know of any way of joining sheet or bandage rubber so that it will be as of one piece? I have used the various kinds of rubber cement, but find that they will not withstand heat or moisture, and will readily come apart on being immersed in warm water. A. Prepare a cement as follows: Digest in a wide-mouthed stoppered bottle a quantity of purified gum rubber (caoutchouc) cut into fine shreds, with just enough bisulphide of carbon to thoroughly soften and convert the gum into a uniform thick paste, assisting the action of the solvent by frequently shaking the bottle. Moisten the edges of the sheets to be joined with a mixture of one part chloride of sulphur and twenty parts bisulphide of carbon, well shaken together; then spread on the cement, bring the parts together and put under strong pressure for twelve hours in a room heated to about 80° Fah. The cement should not be used or kept in the vicinity of fire.

(11) N. A. P. asks: 1. Can you give me a good and at the same time cheap receipt for silver plating, or method of electro-plating small wares, such as spoons, forks, etc.? A. You will find a comprehensive article on silver plating (electro-silver plating) on page 81, vol. xliv. 2. Can I use coin or old silver in the process? A. Coin or old silver can be used, but refined silver is very much better. 3. Also a cheap recipe for making vinegar quickly. A. See quick vinegar process in article on potatoes and their utilization, page 229, current volume. Almost any alcoholic liquid can be used instead of the potato spirit.

(12) M. J. D. asks: 1. What liquids will cut or dissolve gutta percha? A. Bisulphide of carbon, benzine, benzole, or naphtha, and some of the essential oils. 2. How can these solvents be colored a clear dark red? A. Try cochineal, alizarine, or madder red, or lac dye previously ground very fine with a little of the solvent. 3. How can I make a good rubber cement? Do you know of any books on cements? A. You will find good receipts for rubber and other cements on page 810, SUPPLEMENT, No. 188.

(13) A. T. C. says, in reference to our answer to G. B. L. (4), page 186, current volume: "If I understand his question your answer is not correct. Your answer would do for what is called a wiped seam, except, in place of 'hot lead' you should have said hot solder, which is a mixture of 16 parts tin to 31 parts lead. To burn a seam is a very different process, that being done by the flame of the oxyhydrogen blow pipe or a modification of the same principle, hydrogen in combination with a blast of air. The sheets of lead or the edges of which are to be burned are placed one upon the other and cleaned, the flame is applied to the edge of the outer and surface of the inner sheets, and they are melted together drop by drop commencing always at the bottom of the tank. This process requires great skill, and is in hands of a very few. This method of burning sheets of lead together is used in chemical works, where solder would be eaten by acids."

(14) C. V. W. writes: Will you give, through your valuable paper, your opinion of phrenology? Is not it a first class fraud? If you can, will you please give an historical example in which this pretended science has been correct in its demonstration? It is, in our opinion, a veritable occult science, with the aim of preying on the credulity of the public; but then, all persons do not think alike. A. Phrenology is not a "fraud," neither is it an "occult science." Its disciples are often enthusiasts, whose opinions and theories have little scientific value; and to a considerable extent the positions taken by the better instructed believers in phrenology are, in our opinion, at variance with demonstrable facts and theoretical probabilities; but the same can be said of all attempts to solve the problems of mental and moral action and the relation of character to physical structure. As a working hypothesis phrenology has done good service in spite of what seem to us to be errors, and there are reasons for supposing that its term of service is far from completion.

(15) D. J. P. asks: How can copper and silver be most readily separated from alloy with gold—*i. e.*, for the purification of the gold and silver? A. Hammer the pieces into thin ribbons and put them, with about ten times their weight of pure lead, into a good scorifier, which heat in a muffle at a bright red heat until the metals have all melted. When a current of heated air is allowed to play over the surface of the fused alloy the lead (and copper) is gradually slagged off. As soon as the ring of slag formed closes over the entire surface of the fused metal the contents of the scorifier is poured into an iron cup, and when the slag has chilled and cracked off the metal is returned to the muffle in another hot scorifying dish and the slagging off continued until the button is small enough to put into a bone ash cupel. The cupel having been heated to bright redness, the button of metal is cautiously dropped into it. The metal soon melts, the lead and copper gradually slag off—the slag being absorbed into the porous cupel—until a button of pure gold and silver remains. The silver is separated from the gold by means of hot nitric acid, which dissolves the former and not the latter. That this separation may take place it is necessary that the alloy should contain about three times as much silver as gold—enough silver must therefore be added to the alloy if deficient in this metal. The alloy should be hammered out into a ribbon before putting it in the acid, to facilitate the operation. See Assaying, page 339, vol. xliv.

(16) C. J. V. writes: We have a standpipe, 160 feet high and 6 feet in diameter. Would it not take less power to pump in at top of stand pipe with 12 inch pipe than at bottom? A. No.

(17) J. C. asks: How much air is used in the consumption of a pound of wood or coal? A. For bituminous coal, 150 cubic feet air per pound; for anthracite, 196 feet per pound; for wood, about 95 feet per pound.

(18) J. R. asks: Are emery wheels used for grinding plow castings? If so, are they as economical and satisfactory as grindstones? A. Emery wheels are very satisfactory for this purpose. 2. Will a dry grindstone work better on cast iron than a wet one? A. Dry grindstones are generally used in preference to wet ones, principally on account of rust caused by moisture. 3. How will I proceed to make an emery belt? A. Procure an endless belt of cotton webbing, coat it with the best glue, a section at a time, and press it into the emery, which must be made just hot enough to melt glue and not burn it. 4. Is there any kind of tool, less expensive than a diamond, that will work satisfactory for truing up emery wheels? A. No.

(19) A. B. K. asks: 1. Are cast iron magnets used in the various dynamo machines for electric lighting? A. They are used in some machines. 2. What is the comparative magnetic power of cast and wrought iron magnets of the same size, number of turns of wire, and charged by same batteries? A. The advantage is largely in favor of wrought iron, but it varies somewhat with the construction of the machine. 3. Will gas carbon answer instead of graphite in the sulphur and graphite carbons mentioned in late number of SCIENTIFIC AMERICAN? A. Yes, but graphite is preferable. 4. Is the sulphur sold in drug stores free from carbonate? If not, where can such sulphur be obtained? A. It is sufficiently pure for most purposes.

(20) M. writes: We have a five mile telegraph line from this office, with only one wire. The main battery is all at our end, and at this end we also have a good ground connection, but none at the other end. Would our line work better if a good earth connection was at each end? A. You require a good ground connection at each end of your line.

(21) F. I. writes: I have made twelve plates of the Faure accumulator, and coupled them up exactly as described in the SCIENTIFIC AMERICAN of June 25, page 406. I then connected each pole to a Siemens dynamo machine of 2,000 candle power for fifteen minutes, then uncoupled and found that it heated red hot two inches of No. 25 platinum wire, for perhaps two minutes, and at the end of ten minutes could not get any further power out of it. I may say that when the battery was connected to dynamo machine, the belt slipped very much, and it took a large quantity of power to drive it. I therefore thought the battery must be short circuited, and have carefully examined it, and find this not to be the case. Shall be glad if you could point out my failure. What thickness is canton flannel as used by you in your experiment? A. The Faure battery will run down very quickly when short circuited. In charging you should apply less current for a longer time. As canton flannel is soon destroyed by the acidulated water, it would be well to use woolen flannel. You will find it advantageous to separate wrapped plates by two strips of rubber packing one-sixteenth of an inch thick.

(22) J. J. M. writes: Will you please tell about a score of young men in this village from how deep a well can water be drawn up with a common pump? What we want to know most is, what is the greatest distance possible from spout of pump to surface of water? Philosophy tells us that this distance can be no more than 30 feet; then how many feet can we have between lower valve and spout? Is it possible to draw water from a well 60, 80, or 100 feet deep, by having a long pipe? A. If you have not more than 26 or 28 feet from surface of water to plunger valve, you can have any height you like from lower valve to the spout. It is only limited by the power employed in working the pump.

(23) A. G. asks: Can you tell me through your paper if it is practicable and economy to warm a building with the exhaust steam from an engine? Last winter I ran a 10x24 inch engine, and exhausted into a steam drum, 4 feet by 30 inches, through a three inch pipe, then took the steam from the drum through a two inch pipe to the circulating pipes about the mill. I also had a three inch pipe leading from the drum to the open air with safety valve attached, so that I could carry the required amount of pressure to force the steam around the mill, and it required more fuel to run the engine and warm the mill with the exhaust steam than to exhaust in the open air and heat with steam direct from the boiler. I know parties who are running about a 10 horse engine, and have their mill piped with four inch circulating pipe, and no back pressure, and they say it is not economy to use it and do not use it now. What is the reason? A. It has always been considered economical to heat by exhaust steam, and many factories and buildings in New England are so heated. We think in your case your pipes were entirely too small, as they must cause much friction and give but little radiating surface.

(24) A. H. T. writes: Your recent notes and articles on steam boiler explosions have attracted much attention. Your views on the following would be very welcome: A flask of thin glass, two thirds filled with water, is boiled for a moment and tightly corked. The temperature of the water is allowed to fall 20° or 30°, and cold water dashed on the upper part of the flask. The contained water is instantly thrown against the sides of the vessel, shattering it to pieces. For the success of the above it is necessary that the flask be of rather large size, say of two quarts capacity, and that it be of thin blown glass. A steam boiler under similar conditions may be exploded in the same way. The sudden opening of a large valve, or the rupture of some part of the boiler, causes the water contained in it to

be precipitated against its sides, producing a great strain and often a violent explosion. I do not think it possible to *explode* a boiler containing *no water* by forcing steam into it. The boiler would simply be ruptured at its weakest point, as by hydrostatic pressure. A. The conditions you name have been frequently complied with, sometimes by way of experiment and sometimes accidentally. The latest of the latter class is the breaking of the steam pipe of the Plymouth Rock. No explosion followed. Even in a small way, with a thin weak glass flask, the experiment must be made very carefully to be successful. You find no such conditions, as required in your experiment, in the ordinary use of steam boilers.

(25) E. J. D. writes: I wish to pump boiling water on the fruit trees in my orchard, to try and kill the scale bug. In driving a portable steam boiler through the orchard, stopping at every tree, in the stopping and starting the water will slush at the back end and forward end of the boiler, perhaps uncovering the flues of the boiler, the fire still burning in the fire box. I would like to know if there would be any danger of an explosion from the boiler? The steam pressure would be about 30 lb. A. There will be no danger except the tubes be uncovered too long. This action can be checked in a measure by putting in the boiler, above the tubes and crosswise of the boiler, a couple of "swash plates," that is plates on edge, and standing in your boiler say 10 or 12 inches above the tubes, and strongly fastened; these plates to be punched all over with holes, say, three-fourths or one inch diameter.

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

H. & Co.—A talco-argillaceous rock containing much iron sulphide—pyrites.—J. R. E.—An argillaceous hematite iron ore containing mica.—C. W.—Clay iron stone—an impure iron ore.—W. E. H.—Limestone and quartzite.—R. J. McD.—Impure barium sulphate—heavy spar—chiefly used for adulterating whitelead paints.—C. H. E.—The scale is composed chiefly of lime carbonate—not injurious in drinking water.—M. G. S.—A bituminous coal containing a large per cent of ash.—C. E. C.—Your mica is of very fair quality—See Mica, page 257, No. 7, current volume, and Hints to Correspondents.—R. T.—Chiefly magnetic iron sulphide—pyrrhotine.—A. M. K.—It is quartz containing zinc blende and galena—valuable ores of zinc and lead; also a small quantity of iron sulphide—pyrite. The value of such an ore can only be determined by a chemical analysis—it is worth an analysis.—E. S. M.—It is a small fragment of meteoric iron.—S. S.—A bituminous coal containing considerable ash, but nevertheless a good fuel.—D. St. J.—A mixture of limestone, quartzose rock, and carbonate and sulphide of lead—probably silver bearing.—W. F. M. E.—No. 1 is hematite or specular iron ore. No. 2. Orthoclase. No. 3. Silicious limestone.—A. H. H.—The composition contains copal and resin (colophony).—A. E. S.—The sand is not iridium, as you suggest, but magnetic iron ore sand—magnetite.—J. O'B.—It is composed chiefly of hornblende—contains no corundum or emery.—F. F.—The quartz contains much iron sulphide and a little copper sulphide. Not rich enough in the latter to be considered as a copper ore.—N. S.—The garnet sand is of no commercial value here at present.—H. M.—It is gypsum—sulphate of lime—used for making plaster of Paris.

COMMUNICATIONS RECEIVED.

On the Strength of Bricks. By H. F. N.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

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

October 18, 1881,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1866, will be furnished from this office for 25 cents. In ordering please state the number and date of the patent desired and remit to Munn & Co., 37 Park Row, New York city. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications not being printed, must be copied by hand.

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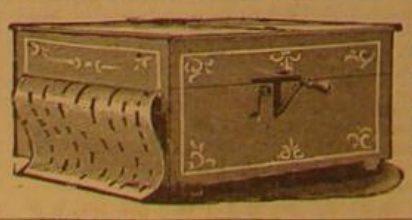

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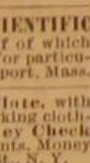

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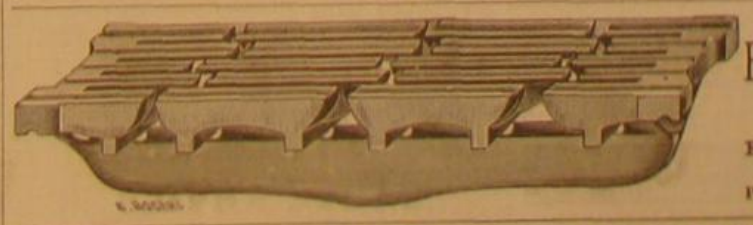

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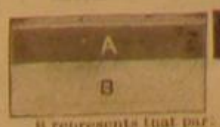

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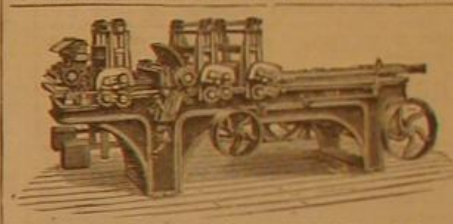

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