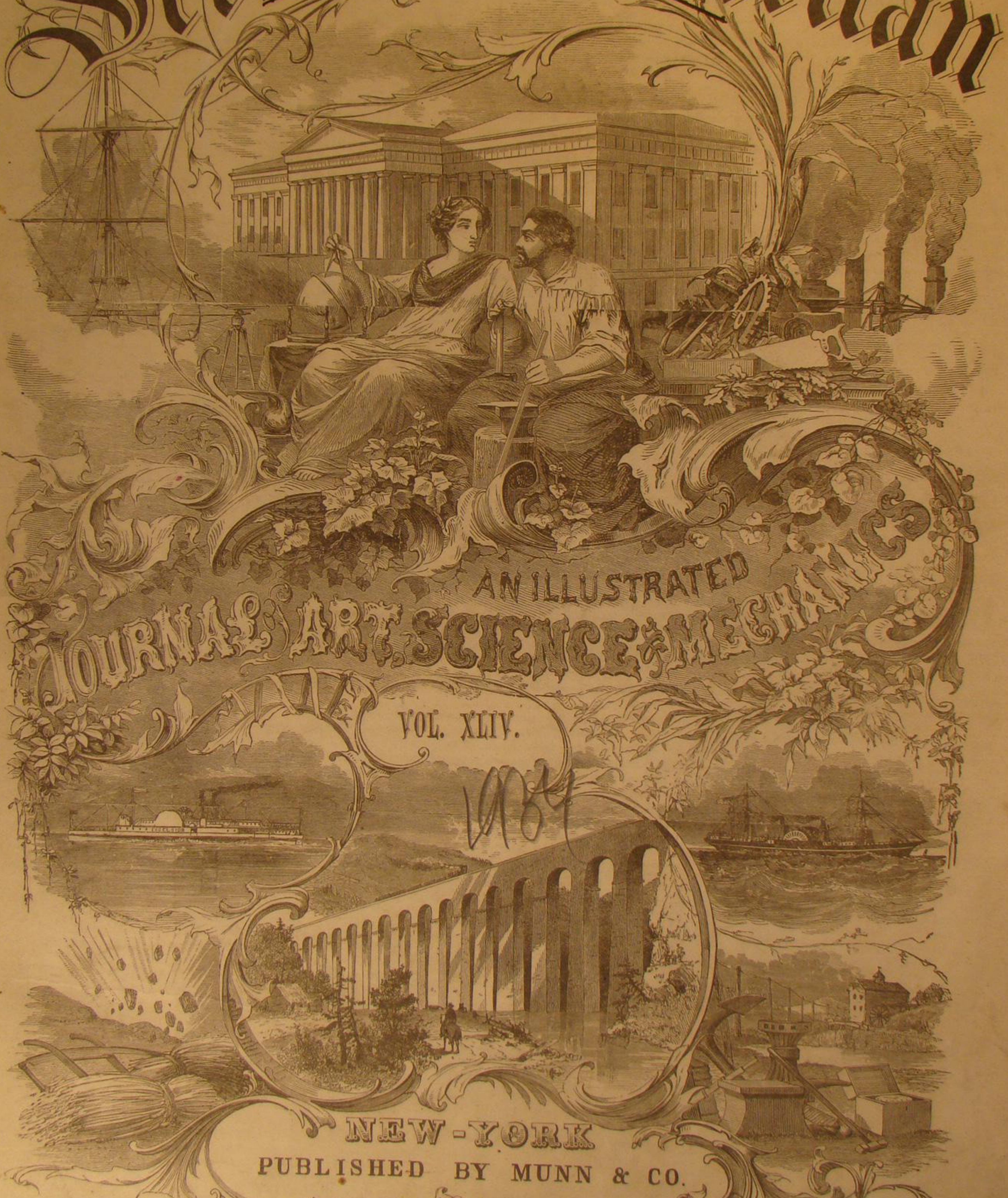
Scientific American



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SCIENTIFIC AMERICAN

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BELL'S PHOTOPHONE.

During a recent visit to Paris, Professor Graham Bell favored *La Nature* with an extended account of the investigations and discoveries which led to and resulted from his late remarkable invention, the photophone. He also supplied our scientific contemporary with certain details not previously made public, together with drawings of his apparatus and experiments, the engravings of which we here reproduce, with *Nature's* translation of the text.

Our readers are already aware that the object of the photophone is the transmission of sounds both musical and vocal to a distance by the agency of a beam of light of varying intensity; and that the first successful attempts made by Prof. Bell and his co-laborer, Mr. Sumner Tainter, were based upon the known property of the element selenium, the electric resistance of which varies with the degree of illumination to which it is exposed. Hence, given a transmitting instrument, such as a flexible mirror, by which the vibrations of a sound could throw into vibration a beam of light, a receiver, consisting of sensitive selenium, forming part of an electric circuit with a battery and a telephone, should suffice to trans late the varying intensities of light into corresponding varying intensities of electric current, and finally into vibrations of the telephone disk audible once more as *sound*. This fundamental conception dates from 1878, when in lecturing before the Royal Institution Prof. Bell announced the possibility of hearing a shadow fall upon a piece of selenium included in a telephone circuit. The photophone, however, outgrew the particular electrical combination that suggested it; for not the least of the remarkable points in this research is the discovery that audible vibrations are set up in thin disks of almost every kind of material by merely throwing upon them an intermittent light. With the photophone as with the telephone, there are instruments of different degrees of perfection. The original telephone of Philip Reis could only transmit musical tones, because it worked by rapid abrupt interruptions of the electric current; while the articulating telephone of Graham Bell was able to transmit speech, since by its essential construction it was able to send undulating currents to the distant receiving station.

We may in like manner classify the forms of photophone under two heads, as (1) articulating photophones, and (2) musical photophones.

Up to the present time, Prof. Bell informs us, the simple receiving disk of ebonite or hard rubber has only served for a musical photophone; the reproduction of the tones of the voice by its means has not yet been demonstrated in practice—at least to his satisfaction. For while it produces unmistakable musical tones by the direct action of an intermittent light, in the experiments made hitherto with articulate speech the instruments have by necessity been so near to one another that the voice of the speaker was audible through the air. Under these circumstances it is extremely difficult to say whether the sounds that are heard proceed from the diaphragm, or whether they merely come through the air to the ear, and if they come from the diaphragm, whether they are really the result of the varying light, and not mere sound vibrations taken up by the disk from the speaker's voice crossing the air. Prof. Bell hopes soon to settle this point, however, by appeal to experiment on a larger scale with the receiving and transmitting instruments at greater distances apart, and with glass windows in between to shut off all sounds.

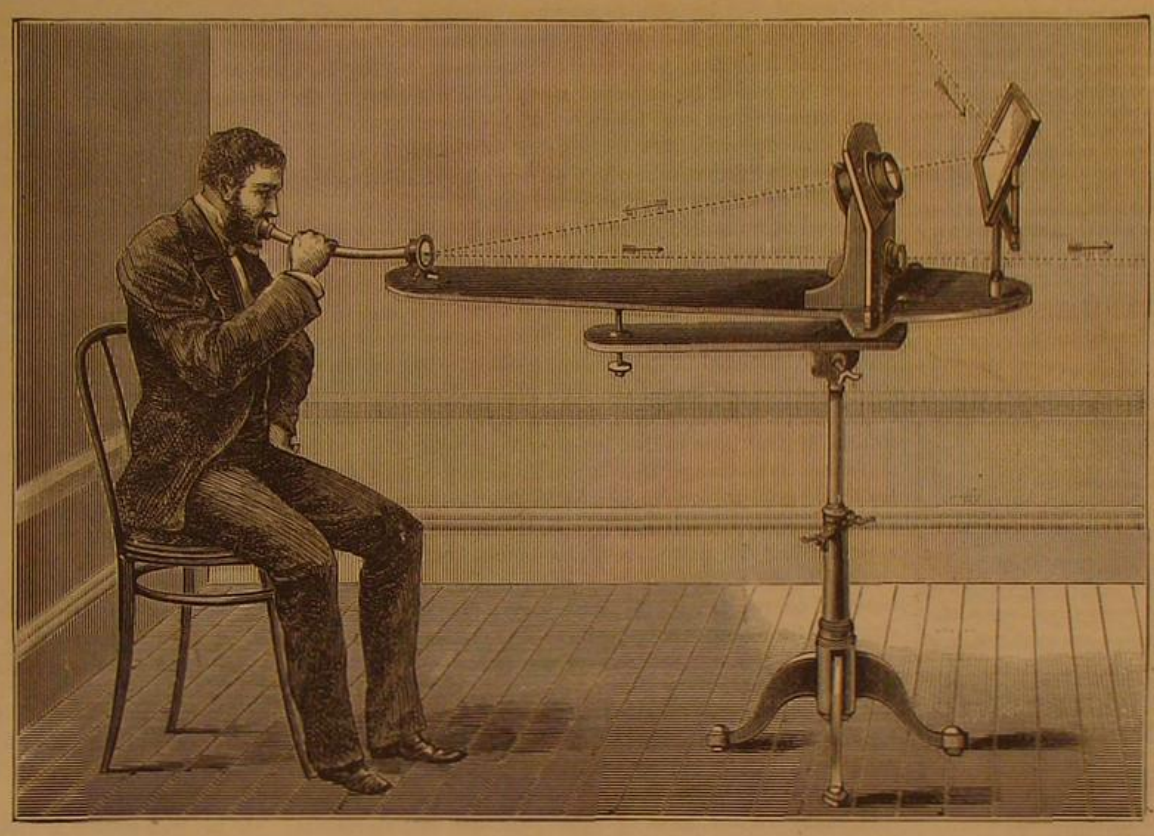

Fig. 5.—THE ARTICULATING PHOTOPHONE—THE TRANSMITTER.

In Fig. 1 we illustrate the simple musical photophone of Bell and Tainter. It might perhaps be described without injustice as an *optical siren*, producing sounds from intermittent beams of light, as the *siren* of Cagniard de Latour produces them from intermittent puffs of air. A beam of light from the sun or from a powerful artificial source, such as an electric lamp, falls upon a mirror, M, and is reflected through a large lens, L, which concentrates the rays to a focus. Just at the focus is interposed a disk pierced with holes—forty or so in number—arranged in a circle. This disk can be rotated so that the light is interrupted from one to five or six hundred times per second. The intermittent beam thus produced is received by a lens, T, or a pair of lenses upon a common support, whose function is to render the beam once more parallel, or to concentrate it upon the disk of ebonite placed immediately behind, but not quite touching them. From the disk a tube conveys the sounds to the ear. We may remind our readers here that this apparent direct conversion of light into sound takes place, as Prof. Bell found, in disks of all kinds of substances—hard rubber, zinc, antimony, selenium, ivory, parchment, wood—and that he has lately found that disks of carbon and of thin glass, which he formerly thought exceptions to this property, do also behave in the same way. We may perhaps remark without impropriety that it is extremely improbable that the apparent conversion of light into sound is by any means a direct process. It is well known that luminiferous rays, when absorbed at the surface of a medium, warm that surface slightly, and must therefore produce physical and molecular actions in its structure. If it can be shown that this warming effect and an intermediate cooling by conduction can go on with such excessive rapidity that beams of light falling on the surface at intervals less than the hundredth of a second apart produce a discontinuous molecular action of alternate expansion and contraction, then the mysterious property of matter revealed by these experiments is accounted for.

However this may be, the musical photophone, as represented in Fig. 1, produces very distinct sounds, of whose existence and dependence for their production on the light the listener may satisfy himself by cutting off the light at any moment with the little opaque disk fixed on the end of the little lever just in front of the holes in disk, R, and which can be worked by a Morse key like a telegraph instrument, thus producing at will alternate sounds and silences. With this musical photophone sounds have been carried by an interrupted beam of light for a distance exceeding a mile; there appears, indeed, no reason why a much greater range might not be attained.

Fig. 6.—THE ARTICULATING PHOTOPHONE—THE SELENIUM RECEIVER.

The articulating photophone is that to which hitherto public attention has been most largely directed, and in which a selenium receiver plays a part. Fig. 2 gives in diagram form the essential parts of this arrangement. A mirror, M, reflects a beam of light as before through a lens, L, and (if desired for the purpose of experimentally cutting off the heat rays) through a cell, A, containing alum water, and casts it upon the transmitter, B. This transmitter, shown again in

[*Continued on page 4.*]

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NEW YORK, SATURDAY, JANUARY 1, 1881.

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(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT
No. 261.
For the Week ending January 1, 1881.

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PATENT ROYALTIES ON SHOE MACHINERY.

The shoe manufacturers of the United States, or at least a considerable proportion of them, have lately been finding fault with our patent laws and the way in which they are enforced, without, as we conceive, a just apprehension of the grounds on which their complaint is based. They recently held a National Convention of the trade in Philadelphia, for the discussion of this question, and matters related thereto, during the progress of which, notwithstanding that many untenable propositions were made, and very extreme opinions were put forward by individual members, it must be allowed that great good sense was manifested, the conclusions reached pointing in what was perhaps the only direction from which practically beneficial results might be reached.

For some years past it has been an extremely unpopular and up-hill work to endeavor to sell to shoe manufacturers a machine for which a royalty was charged on the work done to cover the rights of the patentee. There were many in the trade, including some of its most influential members, who took the position that, for any machine that was of decided advantage to them, they would be willing to pay a sufficient round sum down, and then be the owners thereof, to use as they saw *fit*, while they did not believe it was possible to offer them a machine the payment *for* the patent rights in which was to be made on the basis of a specified tax for each pair of shoes produced. There are, of course, two sides to this question. There are many manufacturers who would not be able to purchase outright a machine covering the introduction of valuable patents, but who would find it no tax, comparatively speaking, to pay such royalty as would be enforced upon all other users of the same improvement, and hence would become a regular item in the cost of production in all goods of the kind. In this way the royalty system, where all are taxed alike, places the small manufacturer on an equal basis with the producer possessed of unlimited means. Perhaps quite as common a ground, however, for the adoption of the royalty system in the introduction of any particular patented improvement, is the skepticism with which new inventions are sometimes looked upon when first brought to the attention of those practically engaged in the particular industry for which the improvements are intended. The old workmen are prejudiced against and look with distrust upon the innovation, so that, if they give to the inventor any credit at all, their allowance is so meager that it would hardly afford a basis for fixing any proper compensation for the improvement, and even this concession is frequently accompanied by the assertion that the patent is for something not new, or not entitled to the protection of a patent. The last question must, of course, always go to the courts for final decision, although the patent itself is prima facie evidence of its own validity. But the manufacturer who takes a machine on trial, the patentee to be paid by royalties, seldom binds himself to pay anything for the improvement unless he finds it valuable to him; in other words, he need not produce his goods with its aid, but may keep on according to his old methods, and so be free from all royalty payments. In this way many of the most valuable patented improvements have been introduced, and, with a little practice and the removal of first prejudices, been made to work successfully, the tax at first being so light as to seem insignificant. The inventor, in fact, has been to all the expense of perfecting his machine, device, or process, overcoming objections thereto, and proving its practical success, before obtaining any return for his outlay, and, therefore, according to all business principles, is entitled to a proportionate reward. There are many inventors and patentees who have traveled this road to meet failure only; many more have achieved a fair degree of success; the few who have won the grand prizes can be counted on the finger ends.

The boot and shoe trade affords one conspicuous instance of the splendid success of a patented improvement, as exemplified in the sole-sewing machine. It was only by a long course of experiment and the investment of a great deal of money that it was perfected; it did not easily obtain a first introduction, so the system of putting it in factories, and allowing the manufacturers to pay for its use a small royalty per pair of shoes made, was the only one then thought practicable, and certainly was at the time eminently satisfactory to the trade. Under the able management of one who was as accomplished a mechanic as he was a shrewd business man, the machine almost revolutionized the boot and shoe manufacture, and has yielded magnificent profits to the patentee.

This triumph, however, gave a strong encouragement to other patentees to adopt the royalty system, and the number has become so great as to cause much opposition to royalties in the trade; and this was a principal topic of discussion at the late convention in Philadelphia. The prime object in calling the meeting was to consult in regard to how much longer the royalties must be paid on the sole-sewing machine.

We noticed, a few weeks ago, the decision of Judge Blatchford, virtually affirming that the patents would hold good, and royalties thereon be collectible, till next August, but there are many in the trade who were not disposed to accept this as final. Ample discussion at the convention, however, showed the doubtful utility of any further contest on this point, as the representatives of the sole-sewing machine patents made it too clearly evident that they had the law on their side. Great as had been their profits, it was not denied that they had done a vast deal for the prosperity of the trade, particularly among small manufacturers; but while they now *stood*, as a strong corporation, ready and able to meet the issues at law with the manufacturers, they were willing to confer and negotiate in regard to such future royalties as had not been decided upon in their favor by the courts. The convention thereupon appointed a committee of representative manufacturers to take charge of such negotiations, not only with this company, but with all others owning patents which were paid for by royalties, with power to commence legal proceedings should they deem such course advisable.

Patentees generally can certainly have no objections to negotiations looking to a settlement in cash in lieu of royalties for their rights, and such moderate action on the part of the convention is far more sensible than it would have been for its members to rush blindly into expensive and almost interminable litigation.

THE PRALL SYSTEM OF HEATING.

During their recent convention in this city the members of the American Society of Civil Engineers were entertained by the Prall Union Heating Company. The dinner was cooked throughout by superheated water; and whatever may have been the cost on the relative economy of the system, the cooking was accepted as unquestionably satisfactory.

That bread can be baked and meat roasted by hot water may seem quite incredible to those who think of boiling water only as commonly seen in open vessels. Under atmospheric pressure water can be heated no higher than 212°, far below a roasting temperature. But when confined there is no limit to the temperature it may receive save the weakness or strength of the containing vessel.

The Union Heating Company propose to supply heat and power to houses by a system of pipes circulating water heated under pressure to about 376°, that is, a pressure of about 160 pounds above the atmosphere. In being conveyed a mile in boxed pipes, under ground, the water, it is claimed, loses not more than 1°, so that a temperature of 375° can be maintained in the pipes of a cooking range, a heat sufficient for all culinary purposes. The heating of houses can be effected either by air currents circulating around hot-water coils, or by means of steam radiators, the hot water being converted into steam in small converting chambers.

In the operation of the system, central boiler stations will be established in districts of about one square mile area. The pipes conveying the superheated water from the central station and back again, are laid in the same trench, and are so connected as to allow a forced circulation. The return pipe conveys to the generator all the water not drawn off for domestic or other purposes, thereby saving all the heat not available for heating purposes or for steam power.

The alleged advantages of this system of circulating superheated water over systems of steam heating consist in the smaller size and cost of the service pipes; in the smaller loss of heat by radiation and condensation, owing to the smallness of the pipes; and the saving of fuel through the return of all the unused condensed water to the central generator.

At the trial station at 125th street about 3,000 feet of pipe have been laid. The water to be circulated is heated to about 342°, and is said to be driven through the system at such a rate that no water is allowed to be more than fifteen minutes away from the boiler. It is estimated that two or three cubic feet of water an hour will suffice for heating an ordinary city house, and that the cost to consumers will be much less than with any other system of heating. To determine this, however, we are inclined to think that something more than brief experimental trials, under the management of the company's engineers, will be necessary. However promising a system may be theoretically, serious difficulties are apt to be encountered when it is put to the test of practical use at the hand of ignorant and unskillful servants. In the ordinary use of steam at low pressure for domestic purposes, leaking joints and valves are a source of constant trouble; much more must they be troublesome under a pressure four or five times as great. At any rate the successful use of superheated water in the way proposed will necessitate a style of valve making and steam fitting marvelously better than builders and house owners are able to obtain now.

THE RESTORATION OF OUR COMMERCIAL AND NAVAL MARINE.

No question before the American people to-day presents so wide a range of problems of national interest, so many problems having a direct and vital bearing on the prosperity and security of the country as a whole, as that which seeks an answer in the restoration of the United States to their former and proper place among the commercial and naval powers.

Our industrial interests cry aloud for a reconquest of the sea by a commercial marine flying the Stars and Stripes. The security of our coasts, not less than the protection of the mercantile fleets which our enterprising traders are bound to set afloat before another generation passes, demands the speedy building of a navy commensurate in magnitude, capacity, and power, with our position as a nation among the ruling nations of the civilized world. The universal reign of arbitration and international peace is yet a long way off; and it will not do for the wealthiest country of the world to leave her great depositories of wealth open to sudden incursions from powers less peacefully inclined. Besides the consciousness of insecurity inseparable from a lack of means

of defense may cost in comfort if not in cash more than the needed defenses would.

We may take it for granted, therefore, that the American people, now that they are comparatively free from pressing demands upon their thought and means arising from internal complications, and now that they have become pretty generally aroused to a sense of their maritime weakness, will pay to naval affairs henceforth that attention which can mean nothing less than ultimate supremacy in this direction. When the American people make up their minds to do a thing it is done, and usually on a scale that is not niggardly or mean.

At this juncture it is timely, to say the least, to inquire what the rest of the world has been doing in naval matters during the period of our naval quiescence. We shall find, as will be shown elsewhere, that other nations have not been idle; indeed, the past ten or fifteen years have covered a period of greater activity in naval affairs than any corresponding period in the history of navies.

Within this period, as has been so forcibly expressed by Chief Engineer King, in his splendid work on the war ships and navies of the world, "all the navies of Europe have been undergoing reconstruction, while those of Asia and South America have been in great measure created. Never has there been a period in time of peace when such large expenditures were being made for naval purposes as at present, and never a period in the history of steam screw navigation when such radical changes were being effected in the construction of ships of war, in the mechanism of steam propulsion, and in the application of machinery to various purposes on board ship hitherto accomplished by hand. Never before have such vast strides been made in so short a time in the fabrication of great guns for naval warfare, necessitating, of course, the introduction of new mechanical appliances for working them; while the development of torpedo warfare and the newly invented methods of operating those dangerous weapons, promise to add to future maritime contests an element hitherto almost unknown."

In all this activity there has been a large measure of progress; chiefly, however, along lines of improvement first marked out by American inventors; a fact clearly recognized by Mr. King in his concluding chapter on the needs of our navy. The beautiful outlines of American fast sailing vessels were copied in Europe. The first war ship propelled by the screw was built in Philadelphia. Shell fire and subsequently heavy guns were first introduced here. The torpedo is an American invention, and so is the revolving turret for vessels of war. It remained, adds Mr. King, for European naval powers, having large appropriations at command, to develop and expand American inventions. The ideas for the present powerful mastless sea-going armored ships of the English grew out of the visits of our turret vessel Miantonomoh to British ports; and the unarmored fleet of fast ships, of which the Inconstant was the first in Europe, owe their development to the building of the Wampanoag.

It is not to be presumed that an approach has been made to the limit of possible improvement in war vessels and their equipment. And there is every reason to anticipate that when American inventors and shipbuilders again turn their attention to naval problems, the radical and daring novelties which made America the pioneer in the creation and development of the several types of modern war vessels and their equipment in use to-day, will be more than paralleled in the evolution of the war vessel of the future. In any case we shall have the advantage of the knowledge gained during the progress of the costly experiments made in Europe during recent years, both in teaching what to do and what to avoid, and our advancement should be correspondingly sure and rapid.

If we could be certain that our present peaceful career will continue unbroken—as we hope it may—for another score of years, some justification might be found for a continuance of the policy of inaction. Indirectly we cannot fail to be benefited by all the improvements, and the failures as well which Europe is making at such heavy cost in naval construction and armament, provided the improvements are not suddenly turned against us while we are unprepared to meet them. To rest, however, on such a precarious ground for idleness would be sheer foolishness, when we know that our coast defenses are antiquated and practically worthless for protection against a heavily armed and armored foe.

It is true that modern wars are not apt to be suddenly declared, and that much might be done in a few months to put our coast in a fair condition of defense. Still it must be borne in mind that many months are required for the construction of powerful cannon and fortresses, whether fixed or floating; and when the emergency comes we may not be called upon to meet a slow moving and honorable enemy, but a gang of dashing and irresponsible private adventurers, who might sail into any of our sea ports any day with a vessel so strong as to enable them to destroy property or levy tribute to a larger amount than the cost of a great navy.

That there is any need of our emulating England and France and Italy in the construction of enormous sea-going iron clads, costing millions each, is not at all apparent. Indeed it may rather seem that the line of experiment in that direction has already been pushed to the utmost extreme, and that the new conditions of naval warfare, as developed in great guns, torpedoes, and so on, demand a radically new departure in naval architecture. In any case it becomes our national government to make provision for such action in our public and private navy yards as shall invite our ship builders and inventors to show what American genius can do to meet our peculiar needs in this direction.

ELECTRO-BRASS PLATING.

Many articles of bronze composition, of zinc, or cheap alloys receive a coating of brass by electric deposition, as a basis for the bronze luster, which is more easily applied and better retained by such a surface. The brass finish is also applied by this method to iron, steel, and composition wire.

The preliminary and finishing operations and the disposition of the baths are the same for brass as for copper deposits. Heat is applied for brass deposits by those who electroplate coils of iron of composition wire, etc., with this alloy. For other articles the baths used are not usually heated. The hot bath is usually contained in an oblong open iron boiler lined with sheet brass, while that for cold plating is generally placed in a wooden tank coated with gutta percha or asphaltum. The anodes are of plate or sheet brass joined together and arranged along the sides, all connected with the last carbon or copper of the same battery. The strength of battery current is regulated by the surface of the articles to be electroplated. The articles are suspended in the usual way—by copper or brass hooks to stout rods of the same metal, all connected with the last zinc of the battery.

THE BRASS BATHS.

Where the ordinary cheap commercial cyanide is employed the following answers very well:

Sulphate of copper	4 oz.
Sulphate of zinc	4 to 5 oz.
Water	1 gall.

Dissolve and precipitate with 30 ounces carbonate of soda; allow to settle, decant the clear liquid, and wash the precipitate several times with fresh water—after as many settlings. Add to the washed precipitates:

Carbonate of soda	15 oz.
Bisulphite of soda	7½ oz.
Water	1 gall.

Stir to effect solution of these last two, then stir in ordinary cyanide of potassium until the liquid becomes clear and colorless. Filter if much iron or iron oxide (derived from impure zinc salt and cyanide) remains suspended in the liquid. An additional half ounce or so of the cyanide improves the conductivity of the solution.

COLD BRASS BATH FOR ALL METALS.

Carbonate of copper (recently prepared)	2 oz.
Carbonate of zinc " "	2 "
Carbonate of soda	4 "
Bisulphite of soda	4 "
Cyanide of potassium (pure)	4 "
Arsenious acid	½ "
Water	1 gall.

Filter if necessary.

The arsenious acid is added to brighten the deposit—an excess is apt to give the metal a grayish-white color.

MANAGEMENT OF THE BATH.

The losses of the bath are to be repaired by the addition of copper and zinc salts (and arsenious acid) dissolved in fresh cyanide, and water.

The operator determines the requirements from the rapidity of the deposit, its condition, color, and so on.

The difficulty in brass electroplating, especially with small baths, is in keeping the uniformity of the color of the deposit, as the electric current having to decompose two salts, each offering a different resistance, must, according to its intensity, vary the color and composition of the deposit. A feeble current principally decomposes the copper salt and results in a red deposit; while too great intensity in the current decomposes the zinc salt too rapidly and the deposit is a white or bluish-white alloy. If the deposit has an earthy or ocherous appearance, or if the liquid is blue or greenish, the solution is deficient in cyanide. When in proper working order the liquor is colorless. If the coating becomes dull and unequal, a slight addition of arsenious acid will usually improve it.

If the deposit is too red, use more battery power or add more zinc salt; if too white, decrease the current or add more copper salt. The specific gravity of the bath may vary from 5° to 12° Baumé; when it exceeds this latter gravity it should be diluted with fresh water to decrease the electric resistance.

If the brass deposit is irregular, remove the articles from the bath, rinse, scratch-brush, and put again into the bath until the color and thickness of the deposit are satisfactory. Scratch-brush again, and, if necessary, rinse in hot water, dry in warm white wood sawdust, and put in the stove room. The last three operations are indispensable for hollow pieces.

In the disposition of the brass plating bath it is always necessary to have all the articles suspended at about equal distances from the anodes.

The bath may be subdivided by several anodes, forming partitions, so that each loaded rod is between two anodes.

The anodes should always be removed when the bath is not in use.

In order that the brass electroplating of zinc or copper may be lasting the deposit must not be too thin, and must be scratch-brushed, washed in lime water, and dried in the stove room.

Generally ten to twenty-five minutes' exposure in the bath suffices in ordinary practice to throw on a good coating. Cast and wrought iron, lead, and its alloys require a bath richer in the metals than when brass plating zinc or its alloys. The battery power should also be greater. For lead the bath works better warm (at about 90° Fah.). When once placed in the brass bath articles should not be moved about, as there is a tendency under such circumstance to the formation of a red deposit.

In brass plating wire the hot bath is usually employed. As before mentioned, the vessel containing the bath usually consists in an oblong open iron boiler, lined with sheet brass anodes, and heated by fire, steam, or hot water. A stout copper or brass rod in the direction of the length of the boiler rests upon the edges, from contact with which it is insulated by pieces of rubber tubing. The rod is connected with the zinc pole of the battery. The binding wires are removed from the coil, the wires loosened, and the ends bent together into a loop. The wire is then dipped into a pickle of dilute sulphuric acid, and hung upon a stout round wooden peg fastened in the wall, so that the coil may be made to rotate easily. After a scrubbing with wet sharp sand and a hard brush the coil is given a primary coating of copper. It is then suspended to the horizontal rod, where only a part of the coil at a time dips into the solution and receives the deposit; the coil is then turned now and then one-half or one-fourth of its circumference. By dipping the coil entirely into the liquid the operation is not so successful.

The wires are washed, dried in sawdust, and then in the stove room, and lastly, passed through a draw plate to give them the fine polish of true brass wires.

The temperature at which the hot bath is commonly used varies between 130° and 140° Fah.

Progress of the Great Bridge Between New York and Brooklyn.

The first shipment of the heavy steel beams for the superstructure of the East River Bridge has been received. Now that the requisite machinery has been made for turning out beams of the required size, the contractors claim to be able to produce them rapidly. The four great cables to be placed under the floor of the bridge from tower to tower, to strengthen the bridge against upward and lateral wind pressures, have also been received. They are regarded as the largest steel wire ropes ever made in this country. These ropes are made in seven strands each.

The central strand has forty-nine No. 11 wires, and the six strands surrounding and enveloping this have nineteen wires each, of Nos. 4, 5, and 7 gauge, making one hundred and sixty-three wires in all. Every wire put into these and all other ropes used in the bridge is tested in strength, elasticity, and tension. The strength must equal 160,000 pounds per square inch cross section. The stretch must be not less than four per cent, and the wire must stand being wound around an iron rod three times its own diameter without showing flaw or fracture.

The great ropes just received are each 1,550 feet in length, 3 inches in diameter, and their aggregate weight is 102,495 pounds.

Death of Henry R. Worthington.

Henry R. Worthington, one of the most prominent hydraulic engineers in this country, died Dec. 17, 1880, in this city, after a very brief illness, at the age of 63 years.

Mr. Worthington was a native of Brooklyn. He engaged in mechanical pursuits at an early age, and became a hydraulic engineer while a very young man. His success in his profession was marked, and he invented a number of important improvements in hydraulic machinery. He constructed the pumping machinery for the waterworks of a great many cities, including that for the new high service works at 97th street and Tenth avenue. He maintained an office at No. 239 Broadway, and was also President of the Nason Manufacturing Company, at No. 71 Beekman street.

He was Vice President of the American Society of Mechanical Engineers, which he assisted to found, and was a member of the Society of Civil Engineers.

The Freight Traffic of the N. Y. Central R. R.

The unprecedented activity of trade this fall is indicated by the unusual traffic of the great lines of railway. During the forepart of December 50 trains, of 38 cars each, passed eastward over the road; a total of 1,900 cars. For the West there was 40 trains, of 45 cars, per day; a total of 1,800 cars. For a week, going East, 13,300 cars; going West, 12,600 cars; a grand total of 25,900 cars. For a month, going East, 57,000 loaded cars; for the West, 54,000; a grand total of 111,000 cars for a month. These statistics are aside from the passenger traffic.

Mount Baker an Active Volcano.

On several occasions during recent years reports have come from Washington Territory that smoke columns and similar indications of volcanic activity had been seen on Mount Baker. A dispatch from Seattle, W. T., dated December 12, says that the mountain was then in eruption, and that a sharp shock of earthquake was felt the evening before.

THE AIR BRAKE PATENTS.—The suit brought by the Westinghouse Company against the Eames Vacuum Brake Company, of Watertown, N. Y., for an alleged infringement of air brake patents, was abandoned December 16, Westinghouse withdrawing the action and paying the costs.

THE ELECTRIC RAILWAY.—Messrs. Siemens and Halske have obtained a concession from the authorities for building an elevated electric railway in Berlin from Lichterfeld to Yeltow.

BELL'S PHOTOPHONE.

[*Continued from first page.*]

Fig. 5, consists of a little disk of thin glass, silvered on the front, of about the size of the disk of an ordinary telephone, and mounted in a frame, with a flexible India-rubber tube about sixteen inches long leading to a mouthpiece. A second lens, R, interposed in the beam of light after reflection at the little mirror, renders the rays approximately parallel. The general view of the transmitting apparatus given in Fig. 5 enables the relative sizes and positions of the various parts (minus the alum cell, which is omitted) to be seen. The screw adjustments of the support serve to direct the beam of light in the desired direction.

It may be well to explain once for all *how* the vibrations of the voice can affect the intensity of the reflected beam far away. The lenses are so adjusted that when the mirror, B, is flat (that is, when not vibrating) the beam projected from the apparatus to the distant station shall be nearly focused on the receiving instrument. Owing to the optical difficulties of the problem it is impossible that the focusing can be more than approximate. Now, matters being thus arranged, when the speaker's voice is thrown against the disk, B, it is set into vibration, becomes alternately bulged out and in, and made slightly convex or concave, the degree of its alteration in form varying with every vibration of the voice. Suppose at any instant—say by a sudden displacement such as takes place when the letter "T" is sounded—the disk becomes considerably convex; the beam of light will no longer be concentrated upon the receiving instrument, but will cover a much wider area. Of the whole beam, therefore, only a relatively small portion will fall upon the receiving instrument: and it is therefore possible to conceive that, if perfectly adjusted, the illumination should be proportional to the displacement of the disk, and vary, therefore, with every vibration with the utmost fidelity. The receiver of the articulating photophone is shown on the right hand side of the diagram (Fig. 2) sketched by Prof. Bell. A mirror of parabolic curve, C C, serves to concentrate the beam and to re flect it down upon the selenium cell, S, which is included in the circuit of a battery, P, along with a pair of telephones, T and T. Here again a general view like that given in Fig. 6 facilitates the comprehension of the principal parts of the apparatus. The sensitive selenium cell is seen in the hollow of the parabolic mirror, which is mounted so as to be turned in any desired direction. The battery standing upon the ground furnishes a current which flows through the selenium cell and through the telephones. When a ray of light falls on the selenium—be it for ever so short an instant—the selenium increases in conductivity, and instantly transmits a larger amount of electricity, and the observer with the telephones hears the ray, or the succession of them—hears, indeed, their every fluctuation in a series of sounds which, since each vibration corresponds to a vibration of the voice of the distant speaker, reproduce the speaker's tones.

The great difficulty to be overcome in the use of the selenium as a working substance arose from its very high resistance. To reduce this to the smallest possible quantity, and at the same time to use a sufficiently large surface whereon to receive the beam of light, was the problem to be solved before any practical result could be arrived at. After many preliminary trials with gratings and perforated disks of various kinds, Prof. Bell and Mr. Tainter finally settled upon the ingenious device to be described. A number of round brass disks, about two inches in diameter, and a number of mica disks of a diameter slightly less, were piled upon one another so as to form a cylinder about two and a half inches in length. They were clamped together from end to end, the clamping rods also serving to unite the disks of brass electrically in two sets, alternate disks being joined, the 1st, 3d, 5th, etc., being united together, and the 2d, 4th, 6th, etc., being united in another series. This done, the edges between the brass disks were next filled with selenium, which was rubbed in at a temperature sufficiently high to reach the melting point of selenium. After this the selenium was carefully annealed to bring it into the sensitive crystalline state. Then the cell is placed in a lathe and the superfluous selenium is turned off until the edges of the brass disks are bared. Fig. 3 shows, in section, the construction of such a shell. Prof. Bell has also used cells in which the selenium filled only the *alternate* spaces between disks, the intermediate spaces being occupied by mica disks of equal diameter with the brass disks. But this arrangement was in no way preferable, for in practice it was found that moisture was apt to penetrate at the surface of the bare mica, spoiling the effect.

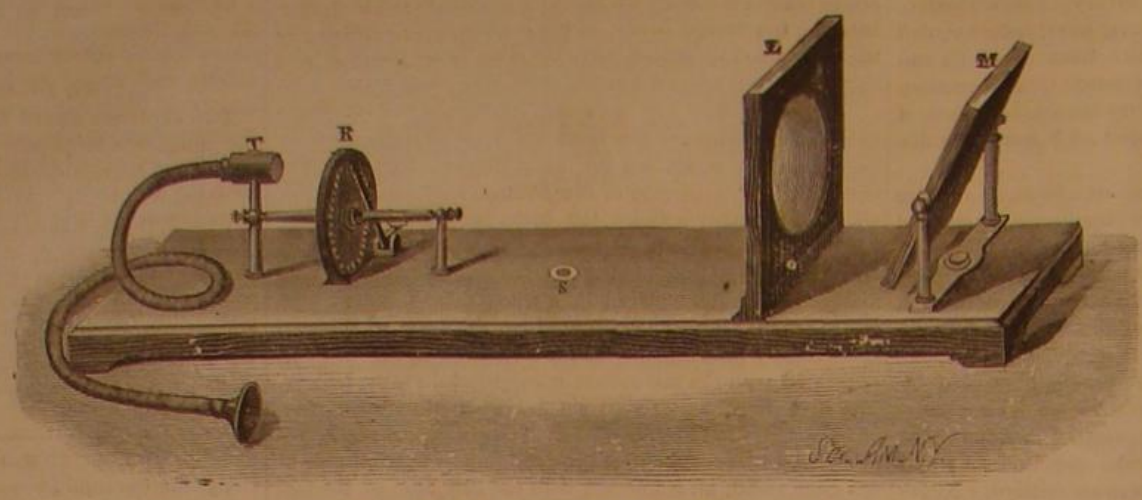


Fig. 1.—THE MUSICAL PHOTOPHONE.

Fig. 4 is a diagram which simply illustrates the action of the selenium receiver, and shows, first, the way of connecting the alternate disks; and, secondly, that the current from the battery, P, cannot go round the telephone circuit without passing somewhere through selenium from one brass disk to the next. The special advantages of the "cell" devised by Prof. Bell are, that in the first place the thickness of the selenium that the current must traverse is nowhere very great; that in the second, this photo electrical action of light on selenium being almost entirely a *surface* action, the arrangement by which all the selenium used is a thin surface film could hardly be improved upon: and that, thirdly, the symmetry of the cylindrical cell specially adapts it for use in the parabolic mirror. These details will be of great interest, especially to those who desire to repeat for themselves the experimental transmission of sound by light. The greatest distance to which articulate speech has yet been transmitted by the selenium-cell-photophone is 213 meters, or 233 yards. When sunlight is not available recourse must be had to an artificial source of sufficient power. During the recent experiments made by Prof. Bell, in Paris, the weather has been adverse, and the electric light has been called into requisition in the *ateliers* of M. Bregnet. The distance in these experiments between the transmitting diaphragm, B, and the parabolic reflector, C C, of the receiver was fifteen meters, the entire length of the room in which the experiments were made. Since at this distance the spoken words were themselves perfectly audible across the air, the telephones connected with the selenium cell were placed in another apartment, where voices were heard without difficulty and without doubt as to the means of transmission. The transmitter shown in Fig. 7 consists of a fixed plate, P, provided with numerous slots and of a like movable plate attached to the diaphragm, *l l*, mounted in a frame provided with a mouthpiece, E. The vibration of the movable plate varies the intensity of the light passing through it. In Fig. 8 the transmitter is shown as used in combination with a collecting lens, L, in place of the parabolic reflector. In Fig. 9 a transmitter is shown which is based upon the effect of electricity on polarized light. A lens, L, throws the beam of a light, F, upon a Nicol polarizing prism, R, and the polarized beams traverse an analyzer, R'. A helix, B, is placed between the two prisms and in the circuit of an ordinary microphone, M. By speaking, the intensity of the current traversing the helix is varied, and this causes the plane of polarization of the rays to be turned more or less, and consequently more or less rays are extinguished by the analyzer, R'.

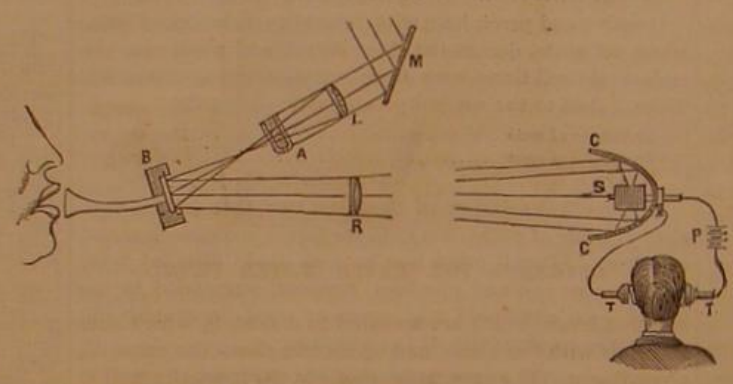


Fig. 2.—THEORETICAL DIAGRAM OF THE ARTICULATING PHOTOPHONE.

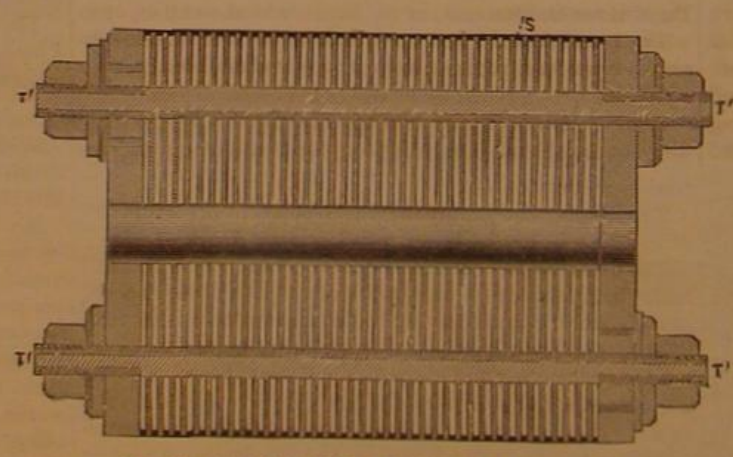


Fig. 3.—SECTION OF THE SELENIUM RECEIVER.

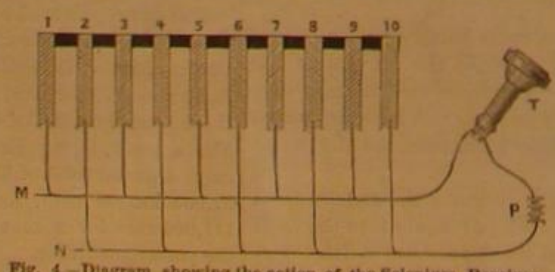


Fig. 4.—Diagram showing the action of the Selenium Receiver.

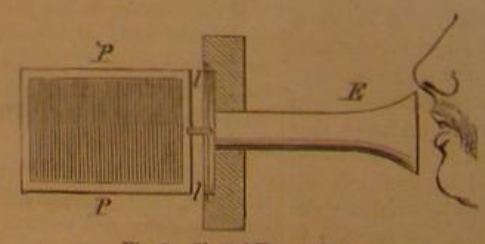


Fig. 7.—Slotted Transmitter.

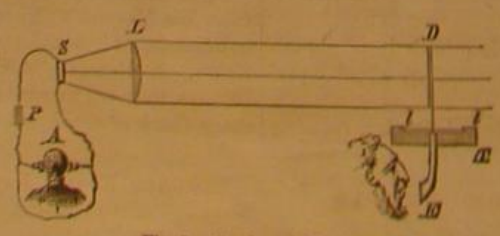


Fig. 8.—Condenser Receiver.

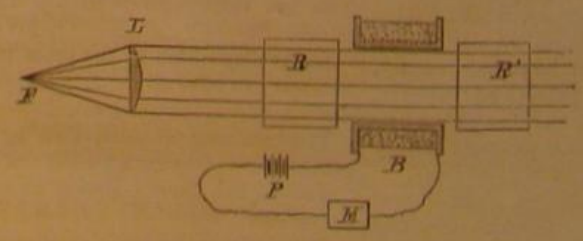


Fig. 9.—Polarized Light Transmitter.

Of the earlier and less perfect forms of the photophone little need be said. One device, which in Prof. Bell's hands worked very successfully over a distance of eighty-six yards, consisted in letting the beam of light pass through a double grating of parallel slits lying close to one another, one of which was fixed, the other movable and attached to a vibrating diaphragm. When these were placed exactly one in front of the other the light could traverse the apparatus, but as the movable grating slid more or less in front of the fixed one, more or less of the light was cut off. Speaking to the diaphragm, therefore, caused vibrations which shut or opened, as it were, a door for the beam of light, and altered its intensity. The mirror transmitter of thin glass silvered was, however, found superior to all others; and it is hard to see how it could be improved upon, unless, possibly, by the use of a thin disk of silver, itself accurately surfaced and polished.

Whatever be the future before the photophone, it assuredly deserves to rank in estimation beside the now familiar names of the telephone and the phonograph.

Responsibility of Employers.

While a boy of 16 was at work upon a printing press in the press room of a New York paper the press was unexpectedly started. The boy sprang back from his dangerous position, and in so doing tipped over the bench he was standing on, causing him to fall against another press, which caught his arm and injured it so as to make it for ever useless. He sued the proprietor in the Superior Court and obtained a verdict for $3,000 damages. The defense was that the accident was caused either by the negligence of the plaintiff or of a fellow workman, for which the proprietor was not responsible. In charging the jury, Judge Speir said that if the plaintiff or a skilled fellow workman were negligent the plaintiff could not recover damages; but that if the agent of the defendant employed persons not skilled in their work and the accident occurred through the negligence of one of such persons, the defendant was responsible. An appeal was taken from the judgment on the grounds that Ju'ge Speir erred in thus charging, and in permitting the plaintiff to exhibit his mutilated arm to the view of the jury, thus arousing their sympathy. The General Term has affirmed the judgment in a long opinion written by Judge Freedman and concurred in by Chief Justice Sedgwick.

Another Cliff Town Discovered.

The occurrence of ancient cliff towns, built upon or rather in almost inaccessible places along the precipitous sides of river cañons in Colorado and New Mexico, was made known several years ago. Another very important discovery of this nature was made a short time since by Mr. James Stephenson, of the U. S. Geological Survey, in New Mexico. The city lies in a cañon thirty miles long, never before visited by white men, and is about forty miles from Santa Fé and ten miles from the Rio Grande. It consists of a succession of excavations in the solid rock throughout the length of the cañon, making, perhaps, the largest cliff town yet discovered.

The houses are dug out of the rock side to a depth of from fifteen to twenty feet. Apparently they were excavated with stone implements. They are almost inaccessible from the plains. Mr. Stephenson, however, managed to clamber up the rocky precipice, and entered and examined a number of articles that he thought remains of their first possessors. A scientist who has traveled in that region and visited other caves and excavations of a similar kind says he is disposed to believe that they have been tenanted within modern times by Indians at war with other tribes, seeking safety and advantage over their enemies. He thinks the remains found there are the remains of the things these belligerents have used, eaten, or worn, and not the relics of the first owners of the rock houses.

The Utilizing of the Tides.

A Philadelphia engineer has invented, it is claimed, a machine by which the power of the tides can be utilized. Numerous plans have been proposed for the accomplishment of this most desirable end, but only under exceptional conditions have they been practical or economical. If the new device can harness the tide in an open channel, so as to convert any considerable portion of the vast power into working force, the inventor will rank among the great benefactors of humanity. Emerson says somewhere: Hitch your wagon to a star. A device for utilizing mechanically the free tides, as they sweep along our shores, would come next to that, since it would enable us, through converters and carriers of electricity, to hitch our wagons to the sun and moon.

CREMATION TEMPLE.

The engraving shows the Cremation Temple lately built in the beautiful cemetery of Milan by Mr. Albert Keller. This temple, built in the Greco-Doric style, is surrounded by columns and pilasters, and surmounted by a cupola, forming a chimney through which the products of combustion escape. The furnace is in the basement, and nearly in the middle of the building. The interior of the building is divided into four large halls, in the first of which the mourners assemble before the body is brought into the urn or cremation chamber; adjoining this hall there is a room in which the bodies in their coffins are awaiting cremation. The next apartment is a large storage room for coal and wood, and beyond this are the furnaces. In an adjoining hall the "Cremation Society of Milan" has its office, and transacts all its business. Here is a curious collection of antique and modern vases, documents relating to cremation, models of furnaces, etc.

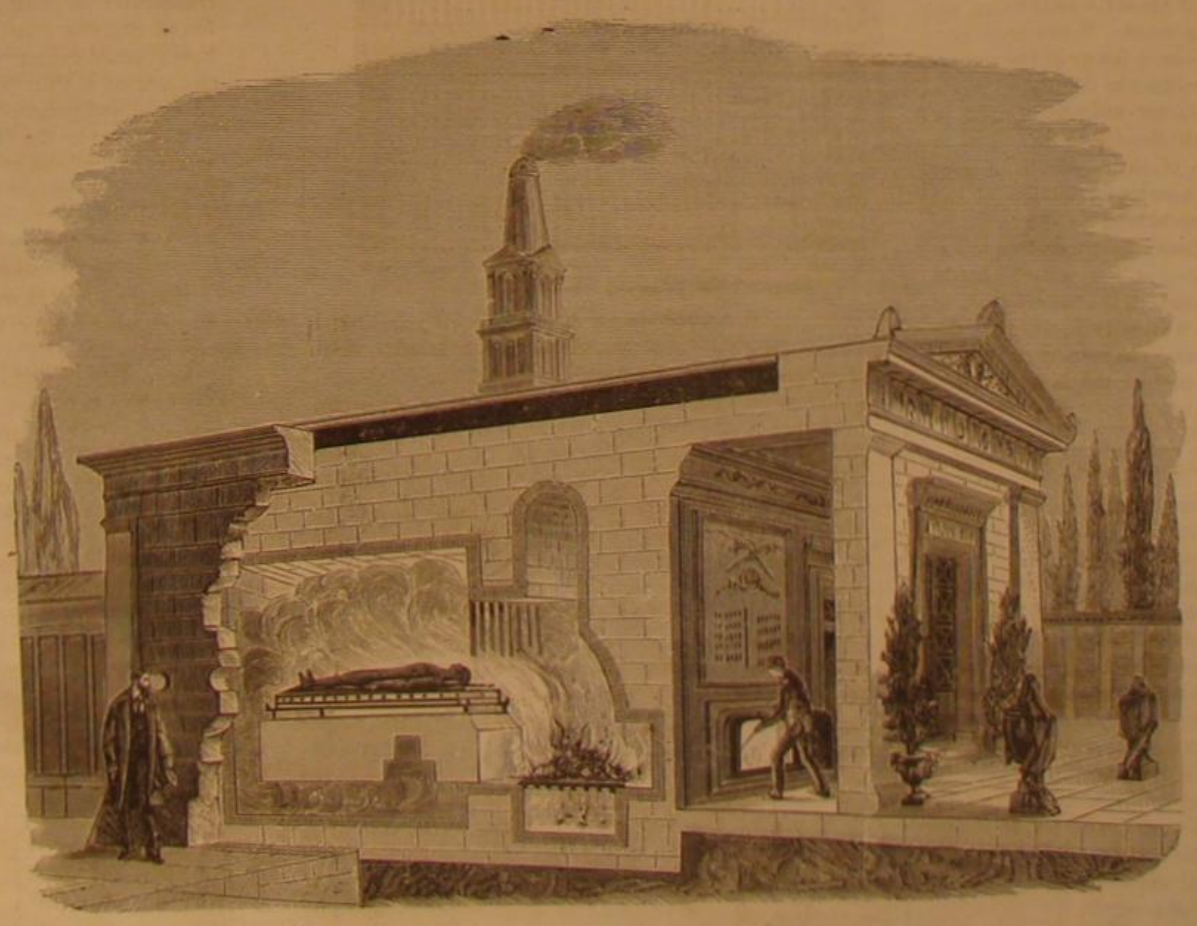
The cremating furnace is arranged transversely in the temple to permit of watching the entire operation through a small window in the side wall of the temple, as shown in the engraving.

The body is placed upon a grate, under which a basin is placed to receive the liquids and ashes that may drop down.

Two furnaces are now before the public, known as the Gorini and Venini furnaces, after the inventors.

The engraving shows Gorini's furnace, in which the flames and products of combustion pass over the body, thence down a flue and under the base upon which the body rests, thence up the chimney. The body, thus completely enveloped in the flames, is converted to ashes in from one and a half to two hours. Wood or coal may be used, and the expense is about one dollar.

Mr. Venini's apparatus is more complicated than that of Mr. Gorini, but it transforms the tissues of the body into gases in a more perfect manner than any other furnace.



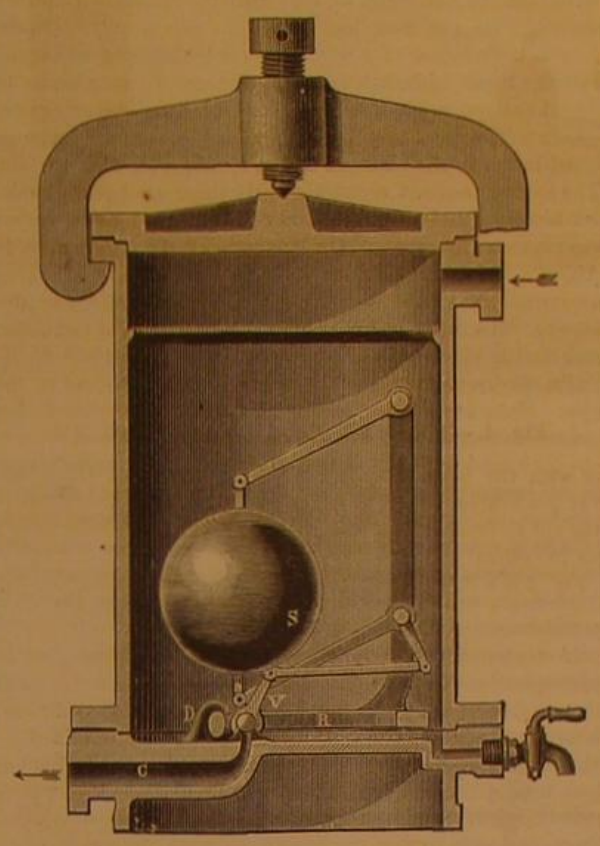
THE MILAN CREMATION TEMPLE.

THE ELECTRIC LIGHTING.—The Commissioner of Public Works, New York city, has granted Mr. Edison a permit to introduce his system of electric lighting in the lower part of this city.

AUTOMATIC GOVERNOR FOR WASTE WATER PIPES.

The governor shown in the annexed cut, taken from the *Deutsche Gewerbe Zeitung*, controls the flow of the waste water from a surface condenser.

The valve, V, which closes the inner end of the outlet, C, is mounted in a frame, R, which has its fulcrum at D, and presses the valve upon the end of the outlet with considerable pressure, insuring a close joint, which is not affected by the accumulation of sediment. The valve is operated by a



GOVERNOR FOR WASTE WATER PIPES.

series of levers which are actuated by a float, S, which rises and falls with the water, and opens and closes the valve, V, accordingly. The apparatus is said to work equally well at low or high pressure.

Uncertainty of Blood Stains in Evidence.

The circumstantial evidence of minute blood stains in criminal cases has been made much of in several recent trials. The value of such evidence has been seriously questioned by Dr. Charles O. Curtman, of St. Louis, who shows that, even when the suspected blood has been shown to be unmistakably human, the accused may plead that the blood stains were caused by predatory insects. In his experimental investigations Dr. Curtman allowed mosquitoes to take their fill of human blood, then, after keeping them in close confinement for periods of varying length, he killed them and examined the blood.

In all cases, up to forty-eight hours after a meal, a large proportion of human blood corpuscles were unchanged and readily recognizable. The size and color of the corpuscles of mosquito blood are very different from human. As the result of more than a hundred careful measurements, he gives the following sizes: Human blood (after imbibition by the mosquito) averages, in dilute glycerine, 1-3200 inch; in 80 per cent alcohol, 1-4000 inch. Mosquito blood averages, in dilute glycerine, 1-14000 inch; in 80 per cent alcohol, 1-18000 inch. In the case of bedbugs it was found that these insects digest blood much more rapidly than mosquitoes do. After twelve hours no trace of human blood was discovered.

An Ice Cave in Montana.

Two explorers named Lambert and Caruthers discovered, last summer, a large cave on the Dry Fork of Arrow Creek, in the Belt Mountains, in which was half an acre of solid ice of unknown depth. At the time of the discovery, about August 1, the ice was covered with ten inches of water, which prevented a thorough exploration of the cave. The Fort Benton *Press* says that the ice gives every indication of being in great body, and it is believed, from its appearance, and the fact that in the hottest season only a few inches of it was melted, that it is perpetual. The cave is described as being a great resort for game, as all kinds were killed close to its entrance.

Pampas Grass.

The cultivation of pampas grass, now so much used for decorative purposes, has become quite a profitable industry in Southern California. Three-quarters of an acre planted in pampas grass yielded, at 2½ cents per head, $500. Another grower sold all he could raise at 7½ cents per head. Last year 10,000 heads or plumes of this grass were sold from that region.

ENGINEERING INVENTIONS.

A circulating device for steam generators has been patented by Mr. Dan Abell, of Carson City, Nev. This invention consists in combining with the feed water and circulation pipes of a steam generator a steam pump for keeping up a continuous and rapid circulation of the water within the space of the generator.

An improvement in that class of devices called "self-couplers" and "uncouplers," has been patented by Mr. Louis C. Slonecker, of Stauffer's Station, Pa. It consists of two spring-actuated spear-headed coupling pins or hooks, pivoted parallel with each other on either side of a vertically adjustable drawhead, and extending forward in front of the drawhead to couple with a like device.

An improved car truck has been patented by Mr. Edward P. Cowles, of Wequiock, Wis. The object of this invention is to provide running gear for a car or other vehicle designed especially to run on round rails, and to avoid the use of flanged wheels and the friction and abrasion caused by them. The invention consists of a car frame of novel design, provided with flat faced vertical wheels to run on the top of the track, and with inclined flat-faced guide wheels that run under the inside edges of the flat wheels squarely against the side of the track.

An improved propeller has been patented by Mr. Rio Gardner, of Westerly, R. I. The invention consists of a hub having short arms, and of blades united thereto by mortise and tenon joints and suitable bolts and screws.

Mr. John Forbes, of Harrisburg, Pa., has patented a core box having a lid fitted for use as a sweep in striking the core and apertured to give access to the box; also, in the combination, with the core box, of flanged tubes for strengthening the legs of the core and giving vent.

Mr. William J. Watson, of Marion, S. C., has patented an improved stump puller, so constructed that it can be readily applied to the stumps and will be powerful in operation. The invention consists in providing a stump puller with a lever strengthened by a truss rod and stud, and having a clevis at its forward end for the attachment of the draught, and a chain at its rear to be attached to a stump, a swiveled standard for connecting wheels, and an axle with the lever to carry it, and a right angled lever for adjusting the carriage and fastening it in place.

Mr. George W. Veil, of Bucyrus, Ohio, has patented a machine for opening and grading tile ditches, so constructed as to leave the bottom of the ditch straight and smooth.

An improved locomotive spark extinguisher has been patented by Messrs. G. A. Gunther, of Bath, and W. Kowalski, of Brooklyn, N. Y. The object of this invention is to deaden or extinguish sparks passing out through the smoke stack of a locomotive. The construction of this device is peculiar and cannot be readily described without engravings.

THE GROWTH OF LARGE ELMS.

A Providence gentleman contributes to the *Journal* of that city an interesting description of the large elms in that neighborhood, with measurements of their girth and spread of limbs at different intervals of time. The latter facts are of more than local interest, since they give a clew to the rate of growth in old trees:

Of No. 1, an uncommonly beautiful tree, the girth at 5 feet from the ground was, in May, 1858, 13 feet 11 inches; in June, 1864, 14 feet 4 inches; in October, 1880, 15 feet 8 inches.

Of No. 2, the smallest circumference was, in May, 1858, 14 feet 9 inches; in June, 1864, 15 feet 2 inches; in October, 1880, 16 feet 6 inches.

Each of these trees gained 21 inches in girth in 21 years. The trees were probably set out in 1748 or 1749.

Of No. 3, at about 6 feet from the ground, the smallest place, the girth was, in May, 1858, 11 feet 11 inches; in October, 1880, 13 feet 4 inches; an increase of 17 inches in 22 years.

No. 4, a conspicuous elm on Congdon street, near Prospect Terrace, is, by its situation, symmetry, and magnificent Medusa-like head, perhaps the most remarkable tree within the old limits of the city. Its trunk is quite uniformly columnar. In January, 1858, it measured, 4 feet from the ground, 11 feet 8 inches; in October, 188 , 12 feet 10 inches; showing a growth of 14 inches in 22 years.

No. 5, perhaps the oldest tree in Providence, measured, at the smallest part between the ground and the branches, 11 feet and 5 or 6 inches in April, 1858; and 12 feet 9 inches in October, 1880.

No. 6, set out about 1790, measured at its smallest circumference, 3½ feet from the ground, January, 1858, 11 feet; April, 1862, 11 feet 4 inches; in 1868, 11 feet 11 inches; October, 1880, 12 feet 11 inches. For 22 years it has gained a full inch of circumference annually; in its entire growth, the yearly gain has been about 1⅛ inches.

No. 7 was set out in 1771, and shows signs of decay. The following measurements were made in July, 1858: Girth at the smallest place, 4½ feet up, 11 feet 2 inches; at 1 foot up, 14 feet; from bough-end to bough-end, north to south, 110 feet, or a little more. Subsequent measurements of its girth, at 4½ feet up, were: April, 1862, 11 feet 5 inches; in 1868, 11 feet 11 inches; November, 1880, 12 feet 3 inches.

No. 8, planted in 1786, is probably a century old. Its chief branch, spreading full 40 feet, shows marks of decay. The girth of this tree, at 6 feet up, was, in July, 1858, 9 feet 8 inches; in October, 1880, 10 feet 11 inches; a growth of 15 inches in 22 years.

Disappearance of Medicinal Plants.

At the recent meeting of the American Pharmaceutical Association, at Saratoga, the president, Mr. G. W. Sloan, in his annual address, spoke at some length on the growth and cultivation of medicinal plants in this country. He called attention to the fact that in California many native plants are disappearing before the incursions of herbaceous species introduced from Australia and Africa. He also discussed the effects of the destruction of forests in this country upon the production of native medicinal plants, commenting on the disappearance of many of the smaller herbaceous species and of shrubs, owing to the clearing away of the underbrush and the pasturage of the woodlands. An effort made in Illinois to raise from seed some of the plants used in pharmacy had met with but indifferent success. Yet, in botanical gardens, experience has demonstrated that almost every kind can be cultivated if judicious selection of the ground is made and close attention is paid to the habits of each plant. As the government shows no disposition to experiment in this direction, he thought the matter should be taken in hand by State Pharmaceutical Associations, in conjunction with State Boards of Agriculture, since the destruction of forests demands attention in respect to the extermination of medicinal plants, just as much as in other important particulars.

Where Our Forests are Going.

To make shoe pegs enough for American use consumes annually 100,000 cords of timber, and to make our lucifer matches, 300,000 cubic feet of the best pine are required every year. Lasts and boot-trees take 500,000 cords of birch, beech, and maple, and the handles of tools 500,000 more. The baking of our bricks consumes 2,000,000 cords of wood, or what would cover with forest about 50,000 acres of land. Telegraph poles already up represent 800,000 trees, and their annual repair consumes about 300,000 more. The ties of our railroads consume annually thirty years' growth of 75,000 acres, and to fence all our railroads would cost $45,000,000, with a yearly expenditure of $15,000,000 for repairs. These are some of the ways in which American forests are going. There are others; our packing boxes, for instance, cost, in 1874, $12,000,000, while the timber used each year in making wagons and agricultural implements is valued at more than $100,000,000.—*Fishkill Standard.*

The Possibilities of American Wheat.

Speaking of our gigantic crops of wheat, the *American Miller* remarks that few people, even in our own country, realize how inexhaustible our resources are for wheat growing. The total area of lands available for wheat culture in the United States is not less than 470,000,000 acres. Our entire wheat crop of the past year, phenomenal though it was, would not supply seed enough to sow so vast an area of wheat land.

Hydrophobia Five Years after Inoculation.

M. Colin related to the Académie de Médecine, at its last meeting, a remarkable instance of prolonged incubation of hydrophobia. The case was that of a man who died a few minutes after being admitted (on August 31) into the hospital, presenting maniacal excitation, expectoration, fear of drinking, and apprehensions, during more lucid moments, least he should injure those about him. The autopsy showed no lesions, but some small cicatrices were noted on the left wrist and in the front of the thorax. Further inquiries showed that the man had been ill two days only. On the first he complained of a severe pain in the hepatic region and extreme thirst, although he could not drink; as soon as he raised the cup to his lips he was seized with shivering and spasm. The next day he complained of severe sense of constriction in the pharynx and a feeling of a wish to bite. The symptoms thus seemed clearly those of hydrophobia. No history could be ascertained of a bite from a dog during the previous five years. On November 2, 1874, however, in Algeria, he had been bitten by a dog, which was attacking a comrade, to whose assistance he went, and who was also bitten. The latter had his wounds cauterized the next day, and died in eight days of hydrophobia. The patient of M. Colin was cauterized half an hour after the receipt of the bite. Some authorities, as Devergie, have maintained that the cases of prolonged incubation are really cases of "nervous hydrophobia;" but the symptomatology of such a case as this seems too precise for the theory that an attack so virulent could result from "nervousness." Hydrophobia is relatively common among the soldiers in Algeria, especially in the interior of the country, at the farms, where there are Arab dogs; and it is still more common among the civil population.

In regard to these prolonged periods of incubation in hydrophobia, of which this case presents an instance most remarkable, if not altogether beyond the reach of criticism, it is worth while to refer to one of the results obtained by M. Pasteur, of which we gave an account last week. It has long been a favorite explanation of these cases to suppose that the virus remained localized in the wound, developed there, and only caused the symptoms when, in consequence of some adventitious circumstance, it passed into the blood. M. Pasteur has shown that this explanation is, as regards some diseases, not a matter of theory but of fact. He has found that in the chronic cases of "cholera of fowls" the poison does develop in certain organs, and not, as in other cases, in the blood, and that when, after a variable period, the organized poison passes into the blood, severe symptoms come on rapidly, and the creature soon dies.—*Lancet.*

The Health of Cities.

Statistics compiled by the National Board of Health show that for the year ending October 31, 1880, the more important cities of the world rank as follows in comparative healthfulness. The death rate shows the number of deaths to each 1,000 persons during the year:

City.	Population.	Death rate.
Chicago	503,298	17·9
Philadelphia	850,000	18·3
St. Louis	333,577	18·8
Boston	375,000	20
Baltimore	393,796	20·9
London	3,254,260	21
Leeds	318,921	21·6
Glasgow	589,598	21·9
New York	1,203,223	23·4
Paris	1,988,806	24
Brooklyn	556,889	25·8
New Orleans	216,359	27·7
Lyons	342,815	27·7
Berlin	1,096,644	29·3
Dublin	314,666	32·9

Antidotes to Arsenic.

In the *American Journal of Pharmacy* for August, 1880, is an excellent method for preparing an antidote to arsenic, which is recommended by Dr. McCaw, a Canadian physician. The following is the formula: ℞. Tincture of chloride of iron, ℥ j.; bicarbonate of soda or potash, ℥ j.; tepid water, a teacupful. Mix.

Dr. McCaw gives a preference for this antidote over all others for two reasons: first, it formed the surest antidote; second, the ingredients are always accessible. That the ingredients are always accessible, the reader will readily see; that it is a sure antidote, I proved by the following experiment: Having prepared the antidote as above described, I let it drain on a filter for a short time, and then mixed a portion of the magma left on the filter with a solution of arsenic containing about half a grain. After stirring the mixture and filtering, the filtered liquid gave no evidence of the presence of arsenic by Marsh's test. This showed the antidote was a sure one.

I was also induced to test the efficacy of another antidote, viz., the freshly prepared sesquioxide of magnesia,* recommended by Bussy. ("U. S. Dispensatory," 14th ed., p. 30.) I dissolved an ounce of sulphate of magnesium in a small quantity of warm water, and added aqua ammonia to saturation, which threw down the proposed antidote. After draining for a short time on a filter, a portion of the magma was mixed with a solution of arsenic, and the mixture stirred and filtered. The filtered liquid gave no evidence of the presence of arsenic by Marsh's test. This would seem to show that the sesquioxide of magnesia is another sure antidote to arsenic, and the fact that the ingredients, Epsom salts and hartshorn, are so often found in the family, gives it an advantage over the antidote recommended by Dr. McCaw.—*Phil. Hoglan, in Pharmacist.*

* The author probably means the hydrated oxide, $Mg H_2O_2$, as we know of no sesquioxide of magnesium.—Ed. *P.*

MECHANICAL INVENTIONS.

Messrs. William G. Wilson and George S. Darling, of Chicago, Ill., have patented improvements in shuttle races for sewing machines. These improvements relate to circular race-ways for oscillating shuttles, and are designed to guide and steady the shuttle as it starts forward and insure its entering the loop of thread.

Mr. William E. Hill, of Big Rapids, Mich., has patented an improved machine for rolling and turning logs upon saw mill carriages and logways, turning the logs upon the head blocks, and pressing them back against the knees. It is simple, convenient, and effective.

An improved support for carriage tops, which can be adjusted forward and backward, as also sidewise, has been patented by Mr. Patrick B. Collins, of South Boston, Mass.

An improvement in bicycles has been patented by Mr. Henry W. Britton, of Stoughton, Mass. The object of this invention is to furnish bicycles so constructed that the rider can adjust his seat to keep it in proper position over the large wheel when riding upon inclined ground.

Mr. Jacob R. Scott, of Nyack, N. Y., has patented an improved machine for sewing boots and shoes, in which the stroke of the needle is automatically varied by the variation in the thickness of the material, so that each stitch will be drawn tight. The invention consists in devices operated by the presser foot to limit the upward stroke of the needle, and in a spring device attached to the horn for retaining the looper in the proper position relative to the needle. The needle bar is hung on a rocking lever supported on a vertical standard which rests at its lower end on a beveled slide block. The slide block is connected by a crank lever with the presser foot, so that the slide block is moved thereby to raise and lower the needle-carrying standard. The horn is fitted with a piece forming the bed and containing the looper.

An improved machine for grinding planer knives has been patented by Mr. Charles J. Le Roy, of Palestine, Texas. This invention relates to an apparatus that may be securely attached to the frame of a wood planing machine for grinding the revolving knives of the planer without removing the knives from its shaft or the shaft from its bearings upon the frame of the machine.

An improved saw-filing machine has been patented by Mr. Philip Bossert, of Lebeck, Mo. The invention consists in pivoting the file holder to a bar adapted to slide horizontally in a swinging frame that is pivoted to a carriage which slides parallel to the saw clamp.

An improved hub for vehicle wheels has been patented by Messrs. Alonzo Gandy and John R. Shugert, of Freeport, O. The object of this invention is to construct a hub for a vehicle wheel so that the box cannot move lengthwise or turn in the hub after the spokes are set, and so that the spoke tenons shall be potected from the contact of the hub or collars.

Mr. Francis Murphy, of New York city, has patented an improved apparatus for forcing exhaust steam from engine into boiler. The invention consists of two vertical cylinders with pistons, each having two suction and two discharge openings. The suction pipes connect with a closed tank, into which the engine exhausts; a check valve prevents the passage of the exhaust steam back to the engine.

Mr. George William Curtis, of Philadelphia, Pa., has patented an improvement in the class of car couplings in which the ordinary closed oval link is employed in connection with a coupling hook, which is pivoted and adapted to slide within a draw head.

Watchmaking in France.

Besançon almost monopolizes the watchmaking of France, all but 2,488 of the 444,798 watches manufactured last year coming from that town. Of the Besançon watches, 149,907 were gold and 292,403 silver, the whole being valued at over $4,00 ,000, half of which represents labor. Nearly all these watches are sold in France. The foundation of the watch trade at Besançon dates from the close of the last century, when a number of workmen from the Swiss side of the frontier, persecuted for their political opinions, took refuge there and were induced to remain. Since then this industry has continued to prosper; but it was not until after the conclusion of the treaty of commerce in 1860 that the business assumed anything like its present proportions. There is a school for teaching watchmaking at Besançon; but though liberally endowed by the municipality, it is said not to be well attended.

What Women Invent.

Some one who has taken the trouble to count the patents issued to women finds that the number for the year ending July, 1880, was seventy, or ten more than the average. Most of the inventions of women have to do with household appliance. Among the past year's are a jar lifter, a bag holder, a pillow-sham holder, a dress protector, two dust pans, a washing machine, a fluting iron, a dress chart, a fish boner, a sleeve adjuster, a lap table, a sewing machine treadle, a wash basin, an iron heater, sad irons, a garment stiffener, a folding chair, a wardrobe bed, a weather-strip, a churn, an invalid's bed, a strainer, a milk cooler, a sofa bed, a dipper, a paper dish, and a plaiting device.

DECISIONS RELATING TO PATENTS, TRADE MARKS, ETC.

United States Circuit Court.—Northern District of New York.

BIGNALL *vs.* HARVEY *et al.*—PATENT FOR COOLING AND DRYING MEAL.

Blatchford, J.:

This suit is brought on reissued letters patent granted to John Deuchfield, January 16, 1872, for fourteen years from April 20, 1858, for an improvement in cooling and drying meal.

1. A printed publication, in order to defeat a patent, must furnish such clear and definite information as to enable a skilled person, beyond any reasonable doubt, by following them, without aid from anything not known when they were made, to construct an apparatus like that patented.

2. A patent granted to a person of one name and reissued under a different—as granted to Deuchfield and reissued to Deuchfield—is a question of identity merely, and proof is always competent in such a case.

Infringement of the first claim of the reissue is proved and not contested. As the patent has expired, there can be no injunction, but the plaintiff is entitled to the usual decree in other respects in regard to said first claim.

The same decision is made in the cases of the same plaintiff against Thomas Elwood and others, Henry Roder and others, and Sidney R. Brown and others.

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United States Circuit Court—Eastern District of New York.

CLARKE, TRUSTEE, *vs.* JOHNSON.

Benedict, J.:

This is an action for an account and an injunction to restrain the defendant from making a certain form of disk used for valve seats in steam joints, upon the ground that such manufacture infringes a patent issued to Nathaniel Jenkins, August 3, 1869, known as reissue No. 3,579, and now owned by the plaintiff.

1. Reissued letters patent No. 3,579, granted to Nathaniel Jenkins, August 3, 1869, construed to be for elastic packing composed of four-tenths refractory earthy or stony matter mixed with rubber prepared for vulcanization by using less than twenty-five per cent of sulphur, and then vulcanized, whence results a material composed of forty per cent and over of refractory matter held together by a skeleton of soft rubber.

2. The patent is not infringed by valve seat disks containing sulphur in excess of the above proportion, whereby vulcanite is formed when the compound is subjected to a vulcanizing heat.

3. Although it is known that both rubber and vulcanite become soft at the temperature at which steam packings are used, it does not follow that the employment of vulcanite for rubber as the skeleton of a packing is a mere substitution of material, particularly in view of the different qualities presented by packings made by the two methods.

4. In *Jenkins vs. Walker* (1 O. G., 359) the excess of sulphur united with lead or litharge to form refractory material, and in *Jenkins vs. Johnson*, the excess of sulphur was taken up by the oxides of lead or iron in a similar manner.

Held that the plaintiff has failed to prove infringement, and the bill is dismissed with costs.

United States Circuit Court.—Northern District of Illinois.

ROBERTS *vs.* SHELDON *et al.*—TRADE MARK FOR NEEDLES.

Blodgett, J:

1. The word "Parabola," registered June 27, 1871, by Robert J. Roberts, of New York, as a trade mark for needles, held to be not descriptive, but an arbitrary term adopted by complainant to distinguish his needles from those of other manufacturers, and his right to so select and apply it affirmed.

2. The use of it by another manufacturer, prefixed by the manufacturer's name, would be, in accordance with a former decision of the court, "that any prefix or suffix used with the trade mark would not give others the right to use it in connection with the manufacture of similar goods," an infringement of the exclusive right of the complainant to use that term to designate goods of his manufacture.

I shall order an injunction on the complainant's filing a bond in the penal sum of $5,000, conditioned for the payment of any damages which the defendant may sustain by reason of the issuing of the injunction, and also require complainant to put in his proof within thirty days after the answer in this case is filed as a condition of the granting of the injunction.

United States Circuit Court—District of California.

THE GIANT POWDER COMPANY *vs.* THE CALIFORNIA VIGORIT POWDER COMPANY *et al.*

Field, J.:

1. Reissued letters patent granted to Alfred Nobel, March 17, 1874, for explosive compounds, declared to be invalid.

2. A reissue can only be had when the original patent is inoperative or invalid from one of two causes—either by reason of a defective or insufficient specification or by reason of the patentee claiming as his own invention or discovery more than he had a right to claim as new—and even then only where the error has arisen from inadvertence, accident, or mistake, and without any fraudulent or deceptive intention.

3. The power to accept a surrender and issue new letters patent is vested exclusively in the Commissioner of Patents. He must judge of the sufficiency of the original specification, whether the same is defective in any particular, whether such defect was the result of an unintentional error, and, if so, to what extent a new or additional specification should be allowed to describe correctly the invention claimed.

4. But this does not preclude the examination by the court of the original and reissued patents, to see whether or not they disclose on their face a case in which the Commissioner has no jurisdiction to act, or a case in which, by his determination, he has exceeded his jurisdiction; if so, the reissued letters patent must fall.

5. The record of a judgment of a judicial tribunal may be in all cases examined to see whether such tribunal had jurisdiction of the subject matter and of the person of the defendant, and if such jurisdiction be wanting the judgment is ineffectual for any purpose.

6. Whenever it appears, on a comparison of the two instruments, that the original patent is valid, it is clear that the Commissioner has exceeded his jurisdiction, and the reissue is without authority of law.

7. When it appears, upon comparison, that the specification of the reissue only differs from the original in containing an invention of broader scope, it is clear that the original patent must be valid if the reissue would be.

8. If the original patent is valid to the extent of its claim, a reissue is without authority of law.

9. Where an invention was described in one portion of the specification as compounded of the explosive substance nitro-glycerine and an inexplosive porous substance, and in another portion of the specification a more detailed description of the porous substance was given without mentioning its inexplosive character: *Held*, that the two passages are to be read together, and that the invention is a compound of nitro-glycerine with an inexplosive porous substance of the character described.

10. Where the original patent described a compound consisting of two ingredients, one of which was an inexplosive porous substance, a reissue covering all porous substances, whether explosive or inexplosive, which would form with nitro-glycerine a compound equally safe for handling, is void as for a different invention.

11. Case of *Russell vs. Dodge* (3 Otto, 463) commented on and approved.

The complainant is the holder of a patent bearing date March 17, 1874, for an alleged new explosive compound known as "dynamite or giant powder." For some time since its issue the defendants have been engaged in making, selling, and using an explosive compound averred to be substantially the same as the compound described in the patent. This suit is brought for the alleged infringement, with a prayer that the defendants may be required to account and pay over to the complainant the income and profits obtained by them from this violation of its rights, and be restrained from further infringement.

The compound patented is claimed to be the invention of Alfred Nobel, a distinguished engineer of Sweden. His invention, whatever may have been its extent, was assigned to one Bandmann, in April, 1868, and in May following a patent for the same was issued to him for the term of seventeen years. Soon afterward Bandmann assigned his interest to the complainant, the Giant Powder Company, a corporation created under the laws of California, and in October, 1873, this company surrendered the patent and obtained reissued letters for the residue of the term. In March, 1874, this reissue was also surrendered and new letters patent were issued, for the infringement of which the present suit is brought.

The bill alleges that the surrender of the original letters, the first reissue, its surrender, and the second reissue were each made for "good and lawful cause," but it does not specify what that cause was. The allegation will, however, be taken to be that the cause was one for which the statute authorized a surrender and a reissue. The bill also alleges that each reissue was for the same invention described in the original patent.

The answer denies both of these allegations and avers that the original letters and the first reissue were not surrendered because they were invalid by reason of a defective and insufficient specification arising from inadvertence, accident, or mistake, without any fraudulent intention on the part of the patentees, and charges that they were surrendered upon false representations with the intent to interpolate and obtain in reissued letters claims and grants for more than was embraced by the invention of Nobel described in the original patent, and that the reissued letters were not for the same invention, but for another and different one. And the defendants insist that for this and other reasons the reissued letters are invalid.

The Commissioner is an officer of limited authority, and whenever it is apparent upon inspection of the patents that he has acted without authority or has exceeded it his judgment must necessarily be regarded as invalid. His action must be restricted to the particular cases mentioned in the statute that only authorizes a reissue when from an unintentional error in the description of the invention the patent is invalid or inoperative, or when the claim of the patentee exceeds his invention. It is not sufficient that the patent does not cover all that the patentee could have claimed if his specifications had come up to his invention. If he has invented or discovered something beyond his original specifications and claim, his course is not to endeavor to cover it by a reissue, but to seek a separate patent for it.

The statute authorizing a reissue was intended to protect against accidents and mistakes, and it is only when thus restricted that it can be regarded as a beneficial statute. If a patentee does not embrace by his specifications and claim all that he might have done, and there has been no clear mistake, inadvertence, or accident in their preparation, the presumption of law is that he has abandoned to the use of the public everything outside of them, or at least has postponed any additional claim for further consideration.

Looking at the original patent and the reissued patent and the specifications annexed to them, we find that the material difference between them is as to the extent of the invention. The original patent covers a compound of nitro-glycerine and an inexplosive porous absorbent which will take up the nitro-glycerine and render it safe for transportation, storage, and use without loss of its explosive power. The reissued patent enlarges the scope of the invention so as to embrace a compound of nitro-glycerine with any porous substance, explosive or inexplosive, which will be equally safe for use, transportation, or storage.

The specifications annexed to the original patent were clear and sufficiently explicit for the compound composed of nitro-glycerine and the inexplosive porous substance mentioned, and the claim was only for a composition of matter made of the ingredients, in the manner, and for the purposes described in them. There was therefore nothing to correct in a reissue, according to the decision in *Russell vs. Dodge* (3 Otto, 463). The claim was as extensive as the invention specified, and there is no pretense that this was not sufficient to cover a compound of nitro-glycerine with inexplosive porous absorbents.

Now, reading the history of the labors of Alfred Nobel to utilize the explosive power of nitro-glycerine and render it safe to transport, handle, and use—the experiments he tried, first, to explode the nitro-glycerine in mass; then in consequence of the dangers attending its use, to prevent its explosion when handled; the patents he obtained in Europe; his experience in the use of gunpowder and other explosives with nitro-glycerine—it is impossible to believe that he intended anything different from the natural meaning of the term he used. He knew well the danger attending the use of nitro-glycerine with explosive absorbents, and in limiting his claim to its use with inexplosive absorbents we must presume that he at that time intended to abandon all claim to compounds of a different character, or at least to leave such claim open for further consideration. If we read his own language in an application made three years afterward for a new patent for a compound with explosive absorbents presented to the Commissioner of Patents by the complainant, and therefore adopted and approved by it, there can be but little doubt on the subject. Soon after the new patent was obtained the application for a reissue was made, evidently that it might reach back to the date of the original patent and cover inventions of other parties during the intermediate period, or that which had gone into public use.

It nowhere appears that he had any knowledge or belief when the first patent was issued that the admixture of nitro-glycerine with explosive substances would produce a safety powder. That was a discovery which he did not make or claim to have made. So when in his specifications he mentions charcoal as an absorbent, he observes that it has the "defect of being itself a combustible material."

To our mind, looking at the history of the invention and reading the specification of the patent in its light, it is clear that the inventor used the word "inexplosive" in its natural and ordinary sense, and that the attempt to limit that meaning is an afterthought of his assignees, desiring to bring within the reach of the patent, compounds in no respect within his contemplation. In other words, the reissued letters cover a compound not claimed by Nobel and not embraced in the original patent.

It follows that, in our judgment, the complainant has no just cause of complaint against the defendants, and its suit must be dismissed with costs; and it is so ordered.

AGRICULTURAL INVENTIONS.

Mr. Abram H. Smith, of Wauseon, O., has patented an improved hay elevator, so constructed that it may be easily operated, and will not allow the loaded fork to settle down or sag while being carried from the barn floor to the mow.

An improved plow truck has been patented by Mr. Henry C. Strong, of Mauston, Wis. The object of this invention is to furnish trucks for moving plows from place to place in manufactories, warehouses, salesrooms, and upon farms. It is so constructed that the plows can be easily moved without danger of breaking, marring, or wearing them.

An improved corn planter has been patented by Mr. Theodore T. Daniels, of Morrison, Ill. This invention relates to an apparatus which may be attached to corn planters of various descriptions for the purpose of opening furrows for the reception of the corn dropped from the seed box.

An improved plow attachment for cultivators has been patented by Mr. Homer J. Potter, of Centralia, Kan. This invention consists in a novel construction, arrangement, and combination of devices connected with a plow beam, whereby provision is made for attaching the plow beam to a cultivator after the cultivator beams have been detached.

A combined cultivator and cotton chopper, so constructed as to scrape, chop, and dirt a row of plants at each passage across the field, has been patented by Mr. James W. Gilbert, of Hoboken, Ala. This machine can be easily controlled by the plowman.

An Improved Glue Dressing for Wounds.

Cabinet makers and wood-workers generally are familiar with the uses of glue in dressing tool cuts and other slight wounds incident to their calling. The glue pot is always handy in their shops, and a glued rag answers as well as the best adhesive plaster.

In a recent paper before the Philadelphia Academy of Surgery, Dr. Hewson recommends the addition of acetic acid to the glue, and a little attar of roses to cover the odor of the glue and the acid. This compound spread on paper or muslin makes, he says, a good substitute for adhesive plaster for surgical use. It is easily and quickly prepared simply by putting into a vessel of boiling water a bottle containing one part of glue to four, by measure, of the acid, and letting the bottle remain in this bath until the glue is fully dissolved and mixed with the acid. Common glue may be used and officinal acetic acid, to be had at any drug store. The mixture should be kept in a wide-mouthed bottle, well stoppered by a long cork, which can always be removed by heating the neck of the bottle. Care should be taken to keep the mouth of the bottle clean by wiping it well with a cloth dipped in hot water. A bottle of this cheap and easily prepared dressing would be a good thing to have at home as well as at the workshop.

A New Cure for Malaria.

There is at least poetic justice in a story that comes from British India, tending to show the power of locomotives (when properly approached) to drive away the malaria which railways, or rather railway construction operations, have so long been charged with causing.

A poor villager of Kattywar had been afflicted for a long time with remittent fever, and no amount of idol worship and penance availed to arrest the malady. At length a friendly neighbor advised him to approach the "Bhoot" in the newest shape in which the former had seen him recently taking his daily run in that part of the province, chafing and fuming. The fever-stricken villager consequently traveled a distance from home, and at sight of a railway locomotive, fell on his knees, tendered an offering of corn and sweets, and extolled its might. The devil was appeased; the worshipper found himself rid of the malaria.

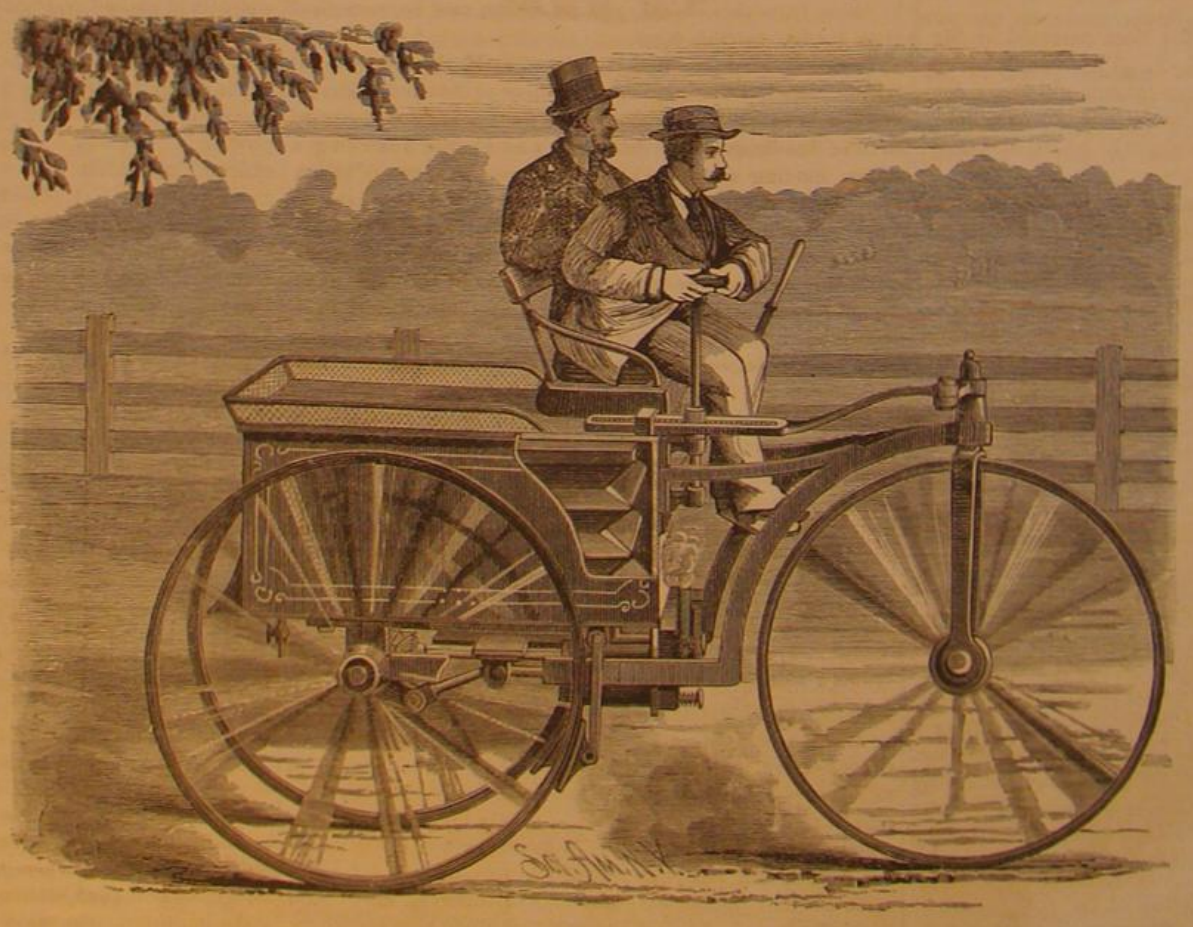
NOVEL ROAD ENGINE.

We have on several occasions illustrated steam road wagons which promised well, but for one reason or another have failed to come into anything like general use. We now give an engraving of a carriage using neither steam nor solid fuel, consequently avoiding the necessity of carrying water and coal. The fuel, which is at the same time the motive agent, is common illuminating gas, which is mixed with a certain proportion of air, and exploded in the cylinder in the manner common to well known gas engines. The engine is secured to a frame, which is supported at the rear by the axle, and in front by a caster wheel, whose frame is provided with a lever moved by a rack and pinion, the shaft of the pinion being provided with a hand wheel, which is turned one way or the other in the operation of guiding the carriage.

The box upon which the passengers sit contains a weighted bellows filled with gas, which is admitted to the cylinder through a valve working across its forward end. The vehicle is provided with a brake which is within easy reach of the driver.

The engine can be instantly stopped and started, and its speed may be varied by varying the amount of gas admitted to the cylinder. A skilled engineer is not required to operate it, as the management of it is very simple. The inventor prefers to use high wheels similar to velocipede wheels, and to connect the piston of the engine directly with a crank formed in the axle, but he is not confined to this construction.

This novel vehicle was recently patented by Mr. C H Warrington, of West Chester, Pa.



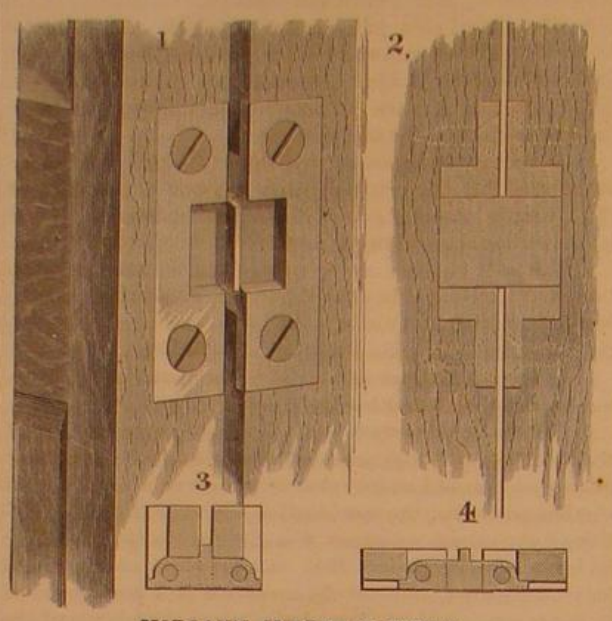
WARRINGTON'S ROAD ENGINE.

International Exhibition of Electricity.

The *Journal Officiel*, of October 26, publishes a letter from the Minister of Post Offices and Telegraphs to the President of the Republic of France, asking that dignitary's co-operation in organizing an International Electrical Congress, which shall be under the auspices of the government in order to give the enterprise that character of independence which is an essential condition of success. The design of the proposed exhibition is to bring together from every source every species of apparatus which is designed to develop, transmit, and utilize electricity. It is proposed to hold the exhibition, if it can be organized, in the Palace of the Champs Elysées from the 1st to the 15th of November of 1881.

IMPROVED HINGE.

The hinge shown in the annexed engraving may be set in flush with the door and jamb, thus doing away with the projection so objectionable in the ordinary hinge. Fig. 1 shows the position of the hinge when the door is open. Fig.



MORGAN'S IMPROVED HINGE.

2 shows the hinge with the door closed. Fig. 3 is a horizontal section of the hinge closed, and Fig. 4 is a section showing it open.

The two leaves, attached respectively to the door and jamb, have each two flanges, between which a connecting link is hung with joint pins. The link has at its center a vertical flange stop, against which the leaves of the hinge strike when the door is closed; it also has flanges at its ends, against which the leaves strike when the door is opened.

It is a simple matter to apply this hinge, as it is always set in flush with the edge of the door and jamb.

As the door is opened the leaf attached to it turns on the link until the door stands at right angles with the jamb, when the leaf strikes the flange on the side of the link, and both link and leaf move together until the door is open. This hinge can be used to advantage on flat surfaces, such as piano covers, writing desks, and cabinet furniture. This invention was lately patented by Mr. John T. Morgan, of New Brunswick, N. J., who may be addressed for further particulars.

New Process of Peeling Peaches.

In certain California peach-drying establishments the work of peeling the peaches has been much simplified by the following process: A crate filled with fruit is dropped into a vat containing hot lye, and there shaken. It is then removed to a tank of pure cold water and the lye is washed away. The skins of the fruit by this process become so separated from the pulp that they are drawn off with one motion of the hand. This saves much time, labor, and expense. The new process causes the fruit to dry more readily, and a very slight loss in weight results.

RECENT INVENTIONS.

Mr. John L. Volkel, of Sulphur Springs, Mo., has patented an improvement in breech-loading firearms adapted for rapid firing. The inventor dispenses with a separate device for extracting the shells, and uses a swinging lever carrying the breech block, that is formed to receive the cartridge and retain it while being fired. The cartridge is thrown out by the act of opening the breech.

A churning apparatus, so constructed as to give a very rapid motion to the dasher by a slow movement of the driving power, has been patented by Mr. Charles B. Davidson, of St. Joseph, Mo.

Mr. Lewis A. Fish, of Faribault, Minn., has patented a simple and convenient device especially adapted for use in flouring mills and feed stores and granaries for holding bags open for filling and conveying them, open or closed, from place to another.

A plow so constructed that the share or point will have a rocking movement while drawn through the ground, to cause it to more thoroughly loosen the soil, has been patented by Mr. Henry F. Edey, of Bridgetown, Island of Barbadoes.

A razor, which is provided with detachable blades, which can be easily removed and replaced, has been patented by Messrs. C. J. J. Sadler, of Milford, Pa., and P. C. Sadler, of New York city.

An improved adjustable wrist-pin, which is simple, convenient, and effective, and prevents noise and irregular motion, has been patented by Mr. Lafayette Thomas, of Marshall, Mo. The invention consists in a wrist-pin formed of a cylinder attached to the pitman and fitting into the cap-shaped head of a pin that passes longitudinally through the cylinder, the pin being held in the desired position by a screw nut provided with teeth in which a sliding spring catch takes and prevents the nut from rotating.

A machine for flattening and sharpening plow colters has been patented by Mr. John T. Duff, of Allegheny, Pa. This invention consists in a novel arrangement of flanges for clamping the colter, and rollers for beveling its edge.

Mr. George H. Williams, of Fort Smith, Ark., has patented a machine for making bricks, so constructed as to mould the bricks, press them, and deliver the pressed bricks upon off-bearing belts automatically. It is simple in construction and rapid in operation.

A cheap automatic cut-off, to regulate the flow of water from the roof of a building into a cistern, for the purpose of directing the first washings of the roof from the cistern, has been patented by Mr. Dennis Brady, of New Orleans, La.

A shank support and protector for boots and shoes has been patented by Messrs. Edson P. Hadley, of Shelburne Falls, and Thomas Joyce, of Buckland, Mass. The object of this invention is to prevent the boot or shoe from ripping at the shank, and by protecting the shank to prevent it from being cut or worn by shoveling, spading, or any pedal labor, or from being burned when the wearer rests his foot on the cope of the grate or stove for warming.

Mr. Ira E. Davenport, of Mechanicsville, Vt., has patented a brake for bob sleighs which consists in a novel arrangement of levers and devices connected therewith, whereby the brakes are applied to the front sled by the momentum of the rear sled when the speed of the team is checked or when holding back in going down hill.

Mr. Charles G. James, of Petaluma, Cal., has patented an improved stock car which is simple in construction, and in which the stock can be housed and fed conveniently.

Frank W. Wardwell, of Cambridge, and Charles E. Lettenmayer, of West Lamerville, Mass., have patented an improved book cover protector, which is simple, cheap, and easily applied.

Messrs. Charlton Patterson and Herman L. Abrahams, of Russell, Kans., have patented a sulky plow in which the adjustable axles can be raised and lowered to regulate the depth at which the plow works in the ground without throwing the wheels out of line, and without affecting the set and gather of the axles.

An improved machine for covering telegraph cables and wires with insulating material and with a leaden protecting envelope, has been patented by Edouard E. Berthoud, of Cortaillod, and Arnold F. Borel, of Boudry, Neuchatel, Switzerland.

An ellipsograph, so constructed that it may be adjusted to describe ovals of different sizes with parallel curves without disturbing the guide pivots, and to cut ovals with their edges straight or beveled in either direction, as desired, has been patented by Mr. Edward L. Gaylord, of Bridgeport, Conn.

An improved ash sifter, which is simple in construction, and which operates without permitting the dust of the ashes to spread as with the ordinary ash sieve, has been patented by Messrs. Augustus F. Morse and George F. McIntosh, of Hallowell, Me. The invention consists in a box provided with a hinged sieve lid provided with a spring bar for holding the ash pan in the box when the lid is closed. The box is provided with a shaft mounted in a larger box provided with a suitable lid, and with an opening in the bottom through which the ashes can drop into a barrel or other receptacle upon which the large box is placed.

An improved suspended or swinging cradle has been patented by Mr. Robert S. Marshall, of Allegheny, Pa. It consists in combining with a cradle a table and two curved connecting rods.

An improved gag runner for harness has been patented by Mr. William H. Chapman, of Middletown, Conn. The invention consists of an elbow stud projecting at right angles from near the tip of the gag runner loop, and having its free end extended above the loop tip.

An improvement in suspenders has been patented by Mr. M. G Gunning, of Amesbury, Mass. The invention consists of a pair of suspenders formed of the shoulder straps passing through and crossing each other in a slide made of two diamond shaped pieces of material united at the angles. The slide moves up and down and adjusts itself according to the position of the body.

An improved receipt book holder, which is especially designed for the use of weighers or other persons that must have the receipt book in a handy and convenient place, has been patented by Mr. Robert B. Dickey, of Waco, Texas.

Mr. Henry Dunphy, of New York city, has patented an improved wash board, whose frame is provided with a soap shelf, a series of polygonal rollers, and a series of brushes alternating with the rollers, so that the dirt may be quickly removed from the clothes, and the clothes made to move easily over the wash board.

An improved churn dasher staff, which is simple and convenient, has been patented by Mr. Lloyd T. Reid, of Rockport, Ky. The invention consists in a dasher staff which is flattened so as to be elastic or flexible at or near the middle of its length or is provided with an elastic piece at the point.

An improved ironing machine has been patented by Mr. John Vandercar, of West Troy, N. Y. This machine is designed especially for use in laundries for smoothing and drying collars, cuffs, and other articles. It is so constructed that the articles to be operated upon will be fed automatically into and through the machines.

A simple and automatic apparatus for leaching ores and other substances on a large scale, has been patented by Messrs. Rudolph Schulder and Edward H. Russell, of West Jordan, Utah Territory. The invention consists of a circular frame supporting the filter and moving on a circular track above an inclined circular table, and of three stationary rollers designed to elevate and depress the filter at certain points as it revolves, of a device for feeding the substance to be leached upon the filter; there is a device for applying the leaching solvent, and a precipitating tank for containing the solution passing through the filter.

An improved lantern hanger for carriages and wagons, which is both simple and convenient, has been patented by Mr. Edwin Lufkin, of Monroe, Me. The invention consists in a wire frame held to the dashboard by a spring arm, and provided with hooks for supporting a lantern and reflector.

Mr. Francis J. Crowley, of Gloucester City, N. J., has patented an improved apparatus for stretching, smoothing, and drying printed cloth, so that crimps, wrinkles, or creases are prevented from being formed in the fabric before it passes to the drying cylinders.

A combined wrench and screwdriver, which is simple in its construction and can be conveniently folded to be carried in a pocket, has been patented by Mr. John K. Collins, of Lebanon, N. H.

An improved gate has been patented by Mr. King A. Scott, of New Douglas, Ill. The invention consists in a novel arrangement of levers and devices connected therewith, whereby the gate may be opened and closed by a person on horseback or in a carriage by the manipulation of handles attached to the levers.

Mr. Juan F. N. Macay, of Charapoto, Ecuador, has patented a process of producing at one operation modified hydrated ferric oxide ($Fe_2O_3OH_3$) and cupric chloride ($CuCl_2$) by the mutual reaction, in the presence of the air, of cupric oxychloride and solution of ferrous chloride.

SCALLOPS.

BY A. W. ROBERTS.

Scallop shells are best known to those who live far inland, as their beauty of form brings them into use for various kinds of ornamental work. The appearance in the shell is shown in Fig. 3, which represents one of nearly full size. For ornamental purposes much smaller ones are used, as they have the advantage of possessing more brilliant colors when young. To see the animal in all its wonderful

Fig. 3.—Animal in Shell, displaying Eyes and Tentacles.

beauty it should be placed in an aquarium or other vessel of sea water. When all is quiet it will open its shells as far as the connecting "mantle" will allow, and this will be seen to be studded with brilliant blue spots which glow like opals. Whether these brilliant spots are really eyes or not has not been clearly ascertained.

The scallop is capable of changing its position, and does so by the forcible ejection of water from a given point.

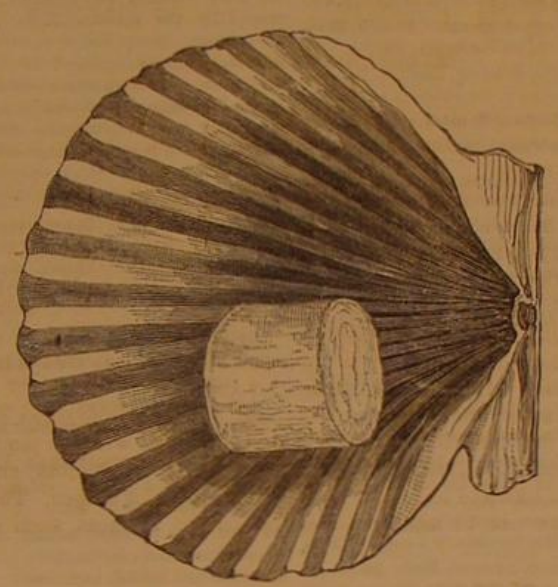


Fig. 2.—Showing Edible Muscle.

This mode of progress is analogous to that employed by the larva of the dragon fly. In Fig. 1 a number of scallops are shown moving about in the water, the drawing of which was taken from a tank at the Aquarium, which was labeled the "dancing scallops," as the scallops were constantly dancing up and down in the water in their peculiar zigzag motions. At one time the scallop shell was worn as a token that the wearers had performed a pilgrimage and paid their devotions to the shrine of St. James of Compostella. The story which connects the scallop shell with St. James is very curious, but too long to be repeated here.

The scallop as seen in the New York market consists of a short creamy white cylinder, and it is a great mystery to many how this can be a shell-fish. This cylinder is the only part of the scallop that can be eaten (the "mantle" or "rims" being very bitter and pungent when cooked, and as far as I know have no other use than that of baiting lobster and eel pots), and consists of the strong muscle that holds the shells together. This is shown in Fig. 2 in its natural position, the rest of the animal being removed. This muscle corresponds with the eye of the oyster, but is much larger in proportion to the size of the animal, it having a similar fibrous structure. It has a remarkably sweet taste, much like that of the flesh of crabs, and is highly relished by many, though not considered as particularly digestible.

The scallop is found in abundance in many localities on our coast from Cape Cod to Florida, particularly in sheltered muddy places.

Fig. 1.—SCALLOPS DANCING.

Astronomical Notes.

OBSERVATORY OF VASSAR COLLEGE.

The computations in the following notes are by students of Vassar College. Although merely approximate, they are sufficiently accurate to enable the observer to recognize the planets. M. M.

POSITIONS OF PLANETS FOR JANUARY, 1881.

Mercury.

On January 1 Mercury rises at 6h. 34m. A.M. On January 31 Mercury sets at 5h. 25m. P.M.

Mercury will approach the sun until the morning of the 26th, when it will reach superior conjunction.

Venus.

Venus sets on the 1st about 8 o'clock P.M. Early on the evening of the 3d Venus will be not far from the moon. On January 31 Venus sets soon after 9 P.M.

Mars.

On January 1 Mars rises at 6h. 4m. A.M. On the 31st Mars rises at 5h. 43m. A.M.

Jupiter.

On January 1 Jupiter crosses the meridian about 6 P.M.

On January 6, between 9 and 9:30 P.M., the moon passes north of Jupiter about 7° in declination.

On January 31 Jupiter sets at 10h. 29m. P.M.

Making our observing hour between 8 and 10 P.M., we find from the "American Nautical Almanac" that on January 1 the first satellite will be invisible, having disappeared in occultation. On January 2, about 10 P.M., the second satellite will disappear in occultation.

On January 8, at a little before 10 P.M., the first satellite disappears in occultation; on the 9th, between 9 and 9:30 P.M., the first satellite comes off from the face of the planet. On January 10 the third reappears from eclipse about 9 P.M.

On January 11 the second satellite, having disappeared in transit before 8 P.M., is invisible.

On January 16, about 9 P.M., the first will pass on to the face of Jupiter.

On January 17, about 8 P.M., the third satellite reappears from occultation; and a little before 10 P.M. the first reappears from eclipse.

On January 20 the second satellite will be hidden in eclipse until nearly 10 P.M.

On January 24, between 8 and 8:30 P.M., the first satellite disappears in occultation, and at about 9:30 P.M. the third also is occulted.

On January 27 the second satellite is invisible, being behind the planet.

Saturn.

On January 1 Saturn will pass the meridian at about 6:30 P.M. On the 31st Saturn will set at 11h. 10m. P.M.

On the evening of January 7 Saturn will be seen near the moon in right ascension, but nearly 8° south of it in declination.

Uranus.

Uranus rises on January 1 at 9h. 47m. P.M., and on the 31st at 7h. 45m. P.M.

Neptune.

Neptune passes the meridian on January 1 at about 7h. 52m. P.M., and on January 31 at about 5h. 54m. P.M.

A Poisonous Fly Bite.

John Story, a warehouse laborer in this city, recently died of malignant pustule caused by the bite of an insect which looked like a fly.

Story was at work in a tobacco warehouse, and, while handling a bale of Havana tobacco, he felt a sharp pain in the left side of his neck. Instantly he clapped his hand on the spot, and a winged insect, which he took to be a gnat, flew away.

The pain was but temporary, and he paid no attention to it until the following day, when an inflamed pimple had formed on the spot where he had been bitten. This pimple annoyed him considerably, and he tore it open.

The next day the spot was very much inflamed, the inflammation extending in a circle as large as a silver quarter about the wound. The circle quickly enlarged, the inflammation increased, and Story became frightened and called in a physician, who recognized the wound as a malignant pustule, which would undoubtedly prove fatal.

The skin about the wound burst, and the inflammation extended along the neck toward the head, and the lower portion of Story's face was swelled to twice its natural size. Symptoms of blood-poisoning showed themselves, and the patient lingered in great agony for two or three days, when death ended his sufferings.

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.

NEW BOOKS AND PUBLICATIONS.

SCIENCE AND REVELATION. By Dr. Philip S. Hocker. Kansas City, Mo.: Ramsey, Millett & Hudson.

Dr. Hocker has given in a very small pamphlet what he considers "a short and concise solution of some of the problems which have, of late years, attracted the attention of our most profound scholars in Europe and America." In other words, he sets right the "mistakes of Darwin and infidel scientists" in the usual style of those who have but a remote hearsay knowledge of scientific facts and theories.

EXAMPLES OF HOUSEHOLD TASTE. By Walter Smith, State Director of Mass. School of Design. New York: R. Worthington. 4to. pp. 521. $6

Mr. Worthington has laid students of industrial art (and all who wish a permanent remembrance of the art wealth displayed at Philadelphia four years ago) under deep obligation by bringing out so handsome an edition of Mr. Smith's "Industrial Art at the International Exhibition." Five or six hundred fine engravings, many of them full page, exhibit as many objects selected for their conspicuous beauty or the technical skill displayed in their construction. The text is a valuable contribution to the literature of industrial art.

HOUSEHOLD SANITATION:

I. HEALTH AND HEALTHY HOMES: A GUIDE TO DOMESTIC HYGIENE. By George Wilson, M. A., M. D. 12mo, pp. 314. $1.50.

II. DWELLING HOUSES, THEIR SANITARY CONSTRUCTION AND ARRANGEMENTS. By W. H. Corfield, M.A., M.D. 12mo, pp. 112.

III. OUR HOMES. By Henry Hartshorne, A.M., M.D. 16mo. pp. 149. 50 cents.

These three volumes from the press of Presley Blakiston, Philadelphia, cover in a more or less popular way the important field of domestic sanitation, the necessity of maintaining healthy conditions in the homes of the people, and the simpler methods of securing such desirable results. The first on the list discusses the fundamental conditions of healthy living in a manner so admirable in every respect that we should be glad to see it made a text book in every school in the land. There is no branch of vitally useful knowledge so commonly neglected in schools and other institutions of learning, nor any that the community can so ill afford to neglect. Mr. Corfield's book comprises a course of Cantor Lectures before the London Society of Arts. It aims to furnish a short and practical exposition of the means by which dwelling houses may be made and kept wholesome. Though addressed particularly to sanitary engineers and house furnishers, and draws its illustrations of sanitary appliances altogether from British sources, it contains much of direct and suggestive value to American readers. The third book on the list is one of the series of American Health Primers, of whose general excellence we have had occasion to speak in recent issues of this paper. Dr. Hartshorne discusses in a sensible and easily comprehended style the teachings of science and experience with regard to the sanitary influences of situation of houses, their construction, light, warmth, ventilation, water supply, drainage, disinfection, and kindred topics bearing upon the question how to have healthy homes. The publication of works of this nature is an encouraging circumstance. If they could only reach and interest every householder the national sick list and death rate might be cut down to half their present dimensions.

MAGUIRE'S CODE OF CIPHERS: A COMPREHENSIVE SYSTEM OF CRYPTOGRAPHY DESIGNED FOR GENERAL USE. By Charles H. J. Maguire, of the Union Bank of Lower Canada, Quebec. For sale by the author. Price $2.

A system of secret writing based on a combination of any three letters of the alphabet, the keys to be arranged by the correspondents according to mutual agreement to change one or more of the letters. The system has been arranged in conformity with the regulations respecting secret writing telegrams adopted by the International Convention of Telegraph Companies. The vocabulary contains upwards of 18,000 words. There is given besides a large collection of banking, mercantile, and other words and phrases and sentences in common use, geographical names, etc.

THE STUDENT'S ILLUSTRATED GUIDE TO PRACTICAL DRAUGHTING. By T. P. Pemberton. 12mo, pp. 112. $1. For sale by the author, 5 Dey street, New York.

The author, a draughtsman of long experience, has sought to lay down the elements of the art of draughting in a manner so clear that any young mechanic or student of mechanics can easily master them. The instruction is practical throughout, and plainly put.

MODERN ARCHITECTURAL DESIGNS AND DETAILS. Part 2. New York: Bicknell & Comstock. $1.

Plates 9 to 16 show details of store finish, store counters and sections, brackets, gates, and fences, window caps and hoods, architraves, bases and wainscoting, balconies, and two designs for cottages, with front and side elevations, plans, etc.

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.

(1) M. T. asks: What is best to use in a wooden cylinder for smoothing up small turned wood work? A. It is generally sufficient to tumble the articles together without the addition of anything. You might, however, add hardwood turnings or planer chips to advantage.

(2) J. M. asks: 1. What is the best arrangement to get the greatest amount of heat from a small battery or pile? A. By passing the current through a fine platinum wire. 2. What is the best waterproofing process for cotton cloth, outside of caoutchouc and oil? A. See SCIENTIFIC AMERICAN, Vol. 41, p. 251 (5).

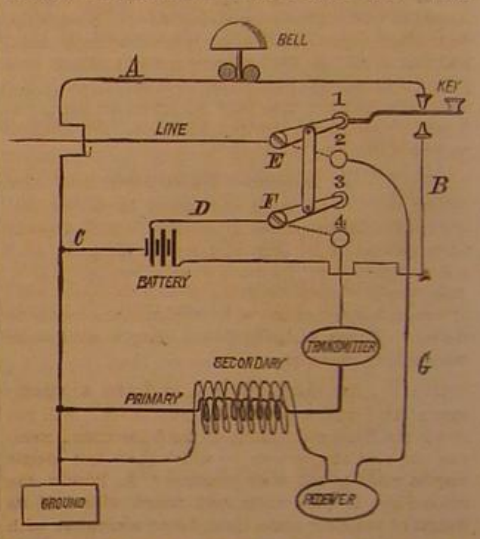
(3) W. R. D. asks whether there is any way of drawing or forcing out escape steam rising from 30 or 40 boiling water tanks which are continually open. The room is about 75x130x35 feet high, with four common ventilators about 4x4x8 feet high. A. It would relieve your trouble to increase the height of your ventilators to 18 or 20 feet, but if this is not sufficient, a fan blower will do it. 2. Is such steam necessarily injurious to health? A. The vapor of water at the pressure of the atmosphere is not injurious to health.

(4) A. H. G. asks: What proportion should the heating surface of a boiler be to the radiating surface in steam coils? I have 13,450 lineal feet of one inch pipe in my building. How many square feet of heating surface should my boiler have to do the work easily? A. In your climate, a horizontal multitubular boiler of about 600 square feet of surface, properly set and fired, will be enough, say, 16 feet long by 48 inches diameter with from 40 to 50 three inch tubes.

(5) P. B. asks: 1. How many one gallon gravity cells would a physician need for all kinds of cauterizing? A. Use the Grenet or Byrne battery for cauterizing. The gravity is not suited to this work. 2. Can sulphate of copper and bichromate of potash cells be united in one battery? A. Different kinds of batteries cannot be worked well together.

(6) J. C. H. asks: 1. Can a room 180x40x11 be heated quicker and more uniformly by placing say 1,290 feet of one inch steam pipe around the room next to the wall (the wall being brick), than by placing the same number of feet of same size pipe in four radiators, to be placed at equal distances apart, either next to the wall or in the center of the room? A. Yes. 2. How much one inch pipe ought it to take to heat properly a room 180x40x11 feet, by either method, for a person to sit to work? The building is exposed on all sides, built of brick. The room is in third story, under a tin roof, the room being ceiled overhead, windows four feet apart all round the room. The lower part of building is kept warm. Steam pressure of the boiler is 60 lb. A. Not knowing the window surface we cannot say correctly, but would think from the description of your building 2,000 to 2,500 feet of one inch pipe distributed around the walls of the building should be sufficient. If you place the same amount of pipe in four radiators, place them where you will, you cannot warm such a room properly; any one sitting in front of a window will have cold feet.

(7) J. S. and others ask how to make telephone connections for an open circuit line. A. The annexed diagram shows all of the connections for one end of the line, both ends being alike. The connections are shown in condition to call or receive a call. When



a call is received the current passes from the line through the switch, E, button 1, key, top contact of the key, bell-magnet, and ground wire, A, to the ground. When the key is depressed to call a distant station, the key touches the lower contact, on the battery wire, B, sending the current through the button 1, switch, E, and line to the bell and ground of the distant station. The current returns by the ground and wires, A, C, to the battery. After calling, the switch, E, is moved to button 2, and the switch, F, being connected with the switch, E, by an insulating connection is at the same time moved to button 4, as shown in dotted lines. Now the line connection is through the switch, E, button 2, wire, G, receiver, the secondary wire of the induction coil to the ground. The switch, F, when turned as described completes the local circuit, the current passing from one cell of the battery through the wire, D, switch, F, button 4, transmitter, primary of the induction coil ground wire, A, and wire, C. The connections are now correct for talking. Should the transmitter be of the class capable of withstanding a heavy current, the wire, D, will be connected so as to include all of the elements of the battery, and the wire, B, instead of being connected with the battery will be connected with the button 3. The diagram shows the connections adapted to the class of transmitters employing but a single battery element, and to a line requiring several cells of battery to call. If a single cell of battery is sufficient to call, the wire, B, will be connected with button 3.

(8) E. F. F. writes: I want to know the velocity of the "electric telegraph." I have consulted many prominent books, but have never been able to ascertain the fact. A. If you mean velocity of the electric current, it varies according to the conditions from 13,500 to 62,000 miles per second.

(9) A. E. R. asks: 1. Is it best to keep a boiler that is not used but a day or two every three months, full of water or empty? No danger of freezing, as it stands beside others in use. A. Keep it full. 2. Do you consider try cocks in a water column as safe as when tapped into the boiler the old way? A. No.

(10) M. S. writes: I have a portable 10 horse power return flue boiler, in which I cannot use water containing organic matter, as it causes foaming. Why is this? A. We think either you have too little steam room, or the circulation is bad. 2. What is the best way to loosen a pump (suction pump) in which the piston is frozen fast, and what is the best preventive of freezing? A. Thaw by the use of hot water. To prevent the freezing open the bottom valve with a hook or other means to let the water out of the pump.

(11) J. A. Y. asks: Where does ice form during the freezing process—upon the surface or the bottom of the stream or vessel? A. Usually on the surface. Anchor ice is an exception.

(12) F. E. K. asks: Will the strings or wires in a well-made piano, when tuned ready to send out of factory, stretch enough to lower the pitch, supposing the tuning pin is securely fastened? A. When piano strings are of the best quality of steel, and have been put on a good pianoforte, they are tuned (in first

class establishments) somewhat above concert pitch, and are kept there by repeated tunings, until the pianoforte has settled and the strings have fully stretched, which is known by the instrument remaining at precisely the same pitch for some time. After this the strings will not stretch except by an increase of the temperature, which will lengthen the iron frame on which the strings are stretched, or by hard use, when, under the constant concussion of the hammers upon the strings, the latter will stretch more or less and get out of tune.

(13) G. R. B. asks: 1. Can you inform me if an induction coil is required with the pan telephone described on page 162, No. 11, current series of the SCIENTIFIC AMERICAN? A. Yes. 2. Should the induction coil used in Blake transmitter be the same resistance as coils in each telephone? A. It should have two or three times the resistance of the telephone coil.

(14) R. R. R. writes: In the Faradic battery operated by an open Smee's cell, I believe the primary wire of the induction coil is composed of two layers of No. 16 or No. 14 cotton covered copper wire. I wish to make an induction coil with the core of the same length and same diameter to be operated with a small Grenet cell. 1. Should the primary wire be constructed as in the former case? Or if modified, in what respect? A. Use three layers of No. 18 wire for the primary. 2. With the same sized core how should the primary be constructed to give the best result with a Bunsen and with a large Leclanche respectively? A. The same construction will answer. 3. With core same size as above, and with secondary coil composed of, say, 10 layers of No. 40 telephone wire, what cell should be used, and how should the primary coil be constructed to get the best results? A. Make the primary as above described, and use a single cell of Grenet.

(15) "Honolulu" writes: I saw a notice in SCIENTIFIC AMERICAN some time ago of the application of electricity to growing crops. Will you let me know the best method of applying it? A. It could not be profitably applied. It is an interesting experiment, and that is all. 2. We are very much troubled with droughts here, and would feel obliged to you if you could give me some idea how to overcome them. A. Your only remedy is artificial irrigation. We know of no way of inducing rain.

(16) A. G. N. asks: What style and size battery would be the most economical to run one electric light on the incandescent principle? A. It depends upon the kind of incandescent lamp and on the time you wish to run it. To run a Werdermann or Regnier lamp for a few hours, probably 20 to 25 one quart cells of Bunsen battery, or one of its modifications, would be the best. To run a single Edison lamp would require more battery elements.

(17) W. A. McA. writes: I have a specimen which I think contains lead and silver. Will you give in the Notes and Queries of the SCIENTIFIC AMERICAN the most simple tests by which these two metals may be made to tell their presence? A. Powder the ore and boil in pure nitric acid mixed with half its weight of water for some time; dilute somewhat with water, and filter. Add to the filtrate a small quantity of sulphuric acid. A precipitate indicates lead. Filter this solution and add to the concentrated filtrate a few drops of pure hydrochloric acid. A white precipitate, insoluble in boiling water, and which changes in color by the action of sunlight, indicates silver. When only very small quantities of the metals are present, unless these tests are performed with great care, the reactions are apt to escape notice altogether. In ores where the silver is in the state of chloride, bromide, etc., this test does not give indications, especially if the silver is present as chloride. The best test for silver in an ore is the fire assay (scorification assay).

(18) F. D. C. asks (1) how to saw petrified wood or other flinty material for sleeve buttons. A. Apply diamond dust moistened with brick oil to the edge of a thin iron disk revolved in the lathe. For full particulars as to stone cutting consult Byrne's "Handbook for the Artisan." 2. How can I make an acid ink to write on oil paper for a stencil to print from? A. Try nitric acid alone.

(19) "Subscriber" asks how to make a black ink suitable for staining leather. A. Use a moderately strong aqueous solution of copperas. The tannin in the leather will develop with it the black color.

(20) V. B. H. asks for a good black paint or something else that will answer to black small castings by dipping them in something that will varnish. A. Dissolve asphaltum in oil of turpentine and add a little lampblack or fine bone black.

(21) L. C. C. asks: 1. Can you inform me where to purchase the ammonia used by the ice machines (not the common aqua-ammonia), think it is called gaseous ammonia, which is liquefied by pressure? A. Liquefied ammonia is not an article of commerce. It is only prepared as required for use. 2. What is known as a 20 ton ice machine? A. One that produces 20 tons of ice a day.

(22) G. W. L. asks what the difference is between tin crystals and tin salts, as used in dyeing. A. Both refer to stannous chloride or protochloride of tin.

(23) E. A. J. asks how to remove the scale from brass castings, to give a surface on which solder may be flowed with a hot copper. A. Dissolve 6 oz. bichromate of potash in three pints of warm water, when cool, add 6 fluid oz. of sulphuric acid. Rinse the castings well after pickling in this solution.

(24) F. R. G. asks how to paint a smoke stack on a small portable engine. It requires something that will resist the action of heat. I have been advised to use asphaltum dissolved in turpentine. A. Good asphaltum dissolved in oil of turpentine is one of the best varnishes for this purpose.

(25) H. M. A. asks: What is the best "stickum" for labels on boxes, also labels on casks; something to make them stick and not cockle or wash off easily? A. Soften glue in cold water and dissolve it in strong vinegar. Mix with it a quantity of dry starch about equal to the glue taken, first having boiled it with water sufficient to form a paste. It works better when warm.

(26) W. J. H. asks if there is any preparation for polishing or staining India-rubber. A. We know of no satisfactory way of staining rubber. Hard rubber may be polished with a little pumice stone and oil.

(27) H. F. P. asks how to make gold ink for writing and printing. A. Triturate gold leaf with a little honey in a mortar until the metal is reduced to a fine state of subdivision; dissolve out the honey with warm water, and mix the gold with a little gum water, used for writing and illuminating. In printing the gold is usually applied subsequent to the printing.

(28) H. L. S. asks: 1. Is there any known substance that if a thin piece of it, say like a piece of paper, window glass, or tin, were placed between a permanent magnet and piece of soft iron would prevent the magnet from attracting the iron? A. No. 2. I would like you to give me a simple illustrative explanation of the theory of how electricity is generated by a dynamo-electric machine. A. You will find this information in an article on dynamo electric machines, in SUPPLEMENT No. 161.

(29) W. E. M. asks: Can you inform me of any metal or alloy that will dissolve by the application of some of the acids (such as sulphuric, hydrochloric, or nitric), and at the same time the acid used to be incapable of any action on fatty substances (such as oils)? A. Metallic zinc is attacked and dissolved by dilute sulphuric acid. The dilute acid has little effect on most oils when used cold.

(30) J. E. S. writes: I wish to make a hollow prism to hold carbon bisulphide, but have not found a cement that will resist it. Can you tell me what to cement the glass with? A. The composition of glue and glycerine used in printing ink rollers answers very well. It melts by aid of heat.

(31) J. E. S. asks: Is there any rapid and practical purpose by which bright copper can be made to acquire the dark rich color that is seen on copper coins unused for many years? The oxide formed by heating scales off easily. A. Clean and dip them in a strong aqueous solution of cupric chloride.

(32) T. R. W. asks: What will take aniline violet and aniline black ink stains out of linen and bleached cotton fabrics? The salts of lemon and oxalic acid seem to have but little influence on it. A. Try solution of bleaching powder or javelle water.

(33) A. L. H. asks: What effect does galvanized iron pipes have on drinking water—good or bad? A. Bad, with certain kinds of water, and especially if allowed to stand in the pipes for any length of time, very bad.

(34) J. C. asks: 1. How can I harden plaster of Paris after making a mortar out of it with water? A. After the plaster becomes thoroughly dry, you may soak it in glue size. When this becomes dry the plaster will be quite hard. 2. What chemical or acid is used in taking a transfer from a printed cut and transferring on a plain block of boxwood? A. Caustic potash dissolved in alcohol. 3. Can I make a mould out of plaster of Paris? A. Oil the pattern, mix the plaster quickly into a thick smooth cream with cold water, and pour into the mould at once. When hardened set aside in a warm place to dry. Is there a book in the market that gives instruction in sculpture: if so, where can it be obtained? A. Address the booksellers who advertise in this paper.

(35) M. C. S. asks: What substances are best to absorb the moisture in a refrigerator? Is crude chloride of calcium (bittern) good? Is lime good? A. Fine unslaked lime will answer about as well as anything. Chloride of calcium is an excellent absorbent of moisture.

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

C. S. C.—It consists principally of sulphides of copper, and possibly carries a trace of gold.—J. W. M.—A silicious kaolin.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

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

November 30, 1880,

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 one dollar. In ordering please state the number and date of the patent desired and remit to Munn & Co., 37 Park Row, New York city. 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.

Accountant instrument, mechanical, H. Johnson 234,875
Aerial apparatus, F. W. Brearey 234,947
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Carpet, T. J. Stearns 12,046
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Crackers, E. W. Albee 8,108
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Razors, knives, shears, scissors, and surgical instruments, G. Knecht 8,106
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Beverage, A. W. Armstrong New York city.
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Crayon holder, J. Reckendorfer, New York city.
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Furnace, J. Wolstenholme Buffalo, N. Y.
Gas making apparatus, C. F. Dietrich, Baltimore, Md.
Heel stiffeners, S. L. Bailey, New York city.
Hoisting machine, T. McCabe, Philadelphia, Pa.
Lamp, W. B. Robins, Cincinnati, Ohio.
Loom, J. Lyall, New York city.
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Pumps, ship, J. Edson, Boston, Mass.
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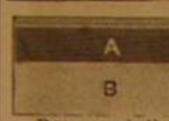

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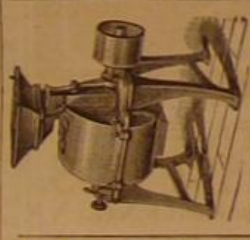

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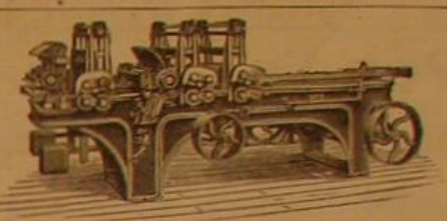

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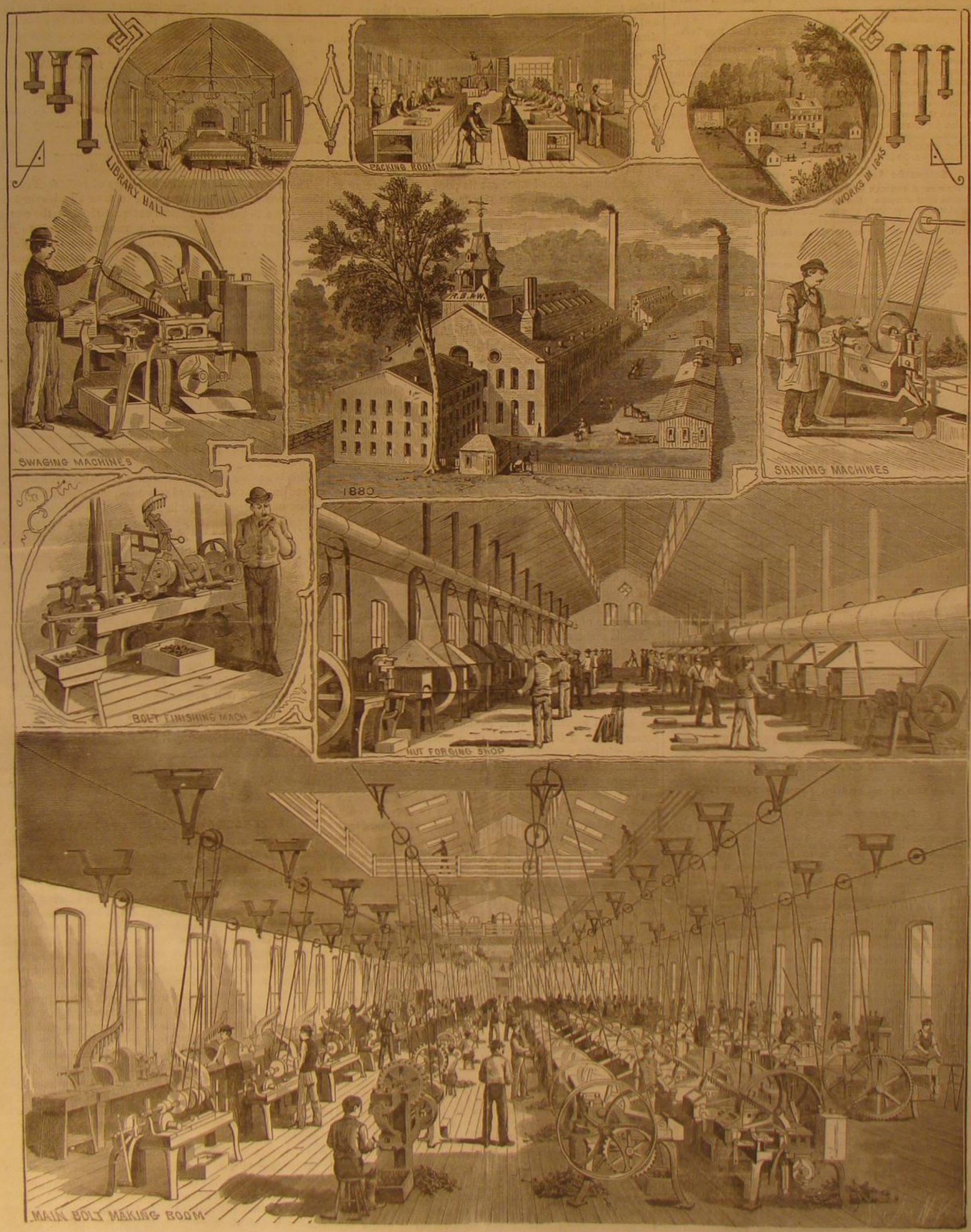

THE MANUFACTURE OF BOLTS AND NUTS—RUSSELL, BURDSALL & WARD PORT CHESTER, N. Y.—[See page 21.]

Scientific American.

ESTABLISHED 1845.

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NEW YORK, SATURDAY, JANUARY 8, 1881.

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(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 262,

For the Week ending January 8, 1881.

Price 10 cents. For sale by all newsdealers.

THE ELECTRIC LIGHTS ON BROADWAY, NEW YORK.

In our issue dated December 25 mention was made of preparations going on for the experimental lighting of a section of Broadway with electric lamps. The promises of the company making the test—the Brush Electric Light Company, of New York—were fulfilled somewhat ahead of the time fixed, and on the night of December 19 the twelve blocks between 14th and 26th streets, including a portion of Madison square, were lighted by sixteen lamps on a single circuit. Although there were already in use in this city, in private establishments, something like a hundred Brush lamps, this was the first application of them to street lighting here, and the experiment naturally attracted much attention. The company proposes to continue the exhibition of the lamps for a month or more, keeping a careful record of the several elements of cost, so that an authoritative decision can be arrived at touching the economy of the system and its ability to take the place of gas in the lighting of our streets. That the electric light is very much cheaper than gas, quantity for quantity, is already abundantly demonstrated and pretty generally recognized; the question to be determined now is whether the vastly brighter illumination demanded when electricity is used, and is really needed for the satisfactory lighting of our streets, can be had at a price which the public is willing to pay.

The difference in the degree of illumination obtained under the two systems is far greater than is popularly supposed. In the section of Broadway lighted by electricity there are sixteen lamps—each of 2,000 candle power—each having at least twice the illuminating power of all the gas lights hitherto used there. Anywhere in the electrically illuminated district it is possible to read type of the size used in the SCIENTIFIC AMERICAN, and the light is purer and more steady than any gas light. Yet the popular impression at first was that the electric light was a trifle dim, and that the lamps should have been placed nearer together.

The company making this experiment was organized under the laws of this State some time last fall, its field of operation being limited to Manhattan Island. As already noted, the Brush system of lighting had been adopted in quite a number of our larger mercantile establishments, and many other merchants and manufacturers favored its introduction, but did not require lamps enough to warrant the purchase of separate generating machines. The success of the system elsewhere made it probable that it would be as favorably received here, and that its general use might be extended not only to the larger shops, warehouses, factories, etc., but also to the public streets and parks. Accordingly the New York company was organized to develop the field. The district selected for the first central station includes a large number of prominent hotels, club houses, theaters, and other places of amusement, and covers what has become the chief shopping district of the city. Seeing the favorable issue of the first street experiment, it is safe to infer that the future progress of the electric light in this city will not be slow. At this writing the wires have been set up as far as 34th street, and it is expected that the company will be officially invited at an early day to submit a bid for the lighting of the square mile of territory around the central station.

Ample preparations are making at the preliminary station for the extension of the system. Already half of a double Corliss engine of 200 horse power has been set up, with three dynamo machines, each capable of sustaining sixteen lamps of 2,000 candle power. Foundations are being prepared for half a dozen more machines of the same size, and one 40-light machine. With the latter type of machine the power required is four-fifths of a horse power to each lamp; with the smaller machines it is a little more, though it is estimated that the completed engine will be able to supply 250 lamps of 2,000 candle power each.

The lamps are of simple construction, very plain in appearance, relatively inexpensive and easy to keep in order. The street lamps are provided with two sets of carbons, each good for eight hours' burning, and so adjusted that when one set is exhausted the current shifts to the other. No clockwork is employed in feeding the carbons, their movement being effected by a simple automatic electric arrangement, which secures a constant adjustment and a remarkably steady light.

It is evident that the contest between gas and electricity for the lighting of our streets has now passed from the theoretical to the practical stage. It is tolerably clear, too, that popular sympathy has a decided leaning toward electricity. It is to be hoped that on the score of cost the tests will result as favorably as they have in respect to the quality of the light.

GROOVE TRACK PAVEMENT.

In his much repeated lecture on "Lost Arts," Mr. Wendell Phillips describes an ancient roadway—Assyrian, if we recollect aright—which was made of stone blocks grooved for the wheels of wagons.

Something similar would seem to be proposed by the Groove Track Pavement Company, of this city, which has applied for permission to place in lower Broadway and the streets leading therefrom to the ferries a complete equipment of five sets of tracks, with three tracks in each set to suit the gauge of every kind of vehicle. The petitioners also ask the privilege of constructing an experimental set of tracks in Union square, as "an entering wedge" toward laying in every street in the city such tracks as would permit the use of compressed air as a motor for all sorts of vehicles. Whether these tracks are to be accounted public highways does not appear, though if they are not it is obvious that the public would not long be left with any usable portion of their own streets, should the petition be granted. The petitioners further ask for the privilege of running light and convenient vehicles for carrying passengers and baggage, at a speed not exceeding 20 minutes from Union square to either of the ferries; vehicles to be run at intervals of two minutes; and the fare to be 5 cents, to include the carrying of 50 pounds of personal baggage. The fare, they say further, is to be prorated with all connecting omnibus and horse railroad lines that desire this arrangement, and excluding and prohibiting all other vehicles from carrying passengers, except such as now run in Broadway. In consideration for this decidedly valuable grant, the Groove Track Pavement Company proposed to keep the streets in which their tracks were laid well paved, tracked, and cleaned from dirt or snow, and to pay into the City Treasury one cent for every full fare collected, this amount to be allowed to taxpayers occupying the property bounding the said streets by a corresponding reduction of their taxes.

The scheme is put forth ostensibly for the relief of the blocked and crowded condition of Broadway. It is clear that it would put an end to blockades—by driving off the street all vehicles not owned or licensed by the Pavement Company. The business firms along Broadway would doubtless prefer an occasional "block."

AN UNWISE PHYSICIAN.

There have been no nobler instances of self-sacrifice than those recorded of physicians who, to save a patient or to investigate a disease, have taken extreme risks at the cost of their lives. There is, however, a reasonable limit to such experiments, and no physician is warranted in subjecting himself to needless hazards. If the object aimed at can be gained without incurring any special risk it is obviously the part of wisdom to choose the safer way. The spirit which impelled young Dr. Sanford to choose the more dangerous way, and so lose his life, at Greenpoint the other day, was beyond question commendable; but his act was the reverse of justifiable.

As the case is reported, Dr. Sanford had been attending a child afflicted with malignant diphtheria, watching the patient day and night. At last the air passages became blocked, and the doctor resorted to the use of the knife. He made an opening in the windpipe, inserted a small rubber tube, and with his mouth drew out the poisonous fluid. By this act he prolonged the child's life several hours, but put an end to his own life.

This is not the first fatal instance of the sort which has occurred in this country, and two or three cases of the same nature have been reported in France. The infectious character of the diphtheritic excretion is well known, and Dr. Sanford knew that his life would possibly, if not probably, pay the forfeit for his professional zeal.

Ought he to have taken the risk? More specifically: can we justify his taking the risk?

We have no hesitation in answering, "Certainly not!"

For the simple reason that the deadly matter could have been as promptly and as surely drawn off by purely mechanical means. The emergency was not a sudden one, or one that could not have been provided for beforehand. In any apothecary shop the doctor might have bought for a few cents a rubber bulb that would have served the purpose of an aspirator as well as his own mouth, and it would not have suffered infection from the poisonous matter drawn into it.

Our natural admiration for devotion carried to the point of self-sacrifice is apt to make us forget to ask whether the devotion might not better have been manifested in a more rational and equally effective way. In Dr. Sanford's case we think it might.

INTERNATIONAL EXCHANGE OF FOOD FISH.

While the German carp is being domesticated among us, converting our shallow fishless ponds into reservoirs of wholesome food, several useful fish of this country are being introduced into German waters. Recently 250,000 eggs of the delicious white fish of our great lakes were shipped by the U. S. Fish Commission to the German Fisheries Association, of Berlin. The eggs came from the United States hatcheries at Northville, Mich. The 700,000 eggs of the California salmon, shipped to Germany, France, Holland, and England some months ago, all arrived in good condition. Brook trout have also been sent to Germany, where they can scarcely fail to thrive. Germany has sent us the carp, in return, and also the golden ide, a beautiful and promising fish, which is under cultivation in the ponds of the Maryland Fish Commission.

It is expected that the Berlin Association will send, in addition to the species which have already been received from them, eggs of the saibling or charr, the large and handsome trout peculiar to the deep lakes of Northern Europe. It is highly esteemed as a food fish, and in Lake Constance it sometimes attains the weight of twenty-five pounds.

TEMPORARY DEAFNESS.

According to Dr. H. Augustus Wilson, a very common cause of deafness is the hardening of wax in the ear and the unscientific plan that people adopt for its removal. They generally succeed in making a bad matter worse. The ear is not so exquisitively sensitive to the presence of foreign matter as the eye, and hence those who work at the ear with hairpins and toothpicks are likely to injure themselves irre-

parably. Only the softest materials and the gentlest pressure should be used in cleaning the ear. In a recent clinical lecture, the full report of which we give in the SCIENTIFIC AMERICAN SUPPLEMENT, Dr. Wilson gives, in popular form, some very useful and practical information touching the removal of ear-wax. If the ticking of a watch can be heard at a distance of 28 inches the hearing is good. Each ear should be tested by the watch separately. Noises in the head, sometimes ringing, frequently are due to hardened wax in the ear. Sudden deafness is sometimes caused as follows: A small mass of wax, from ill-health or uncleanliness, becomes hard. A continued secretion of wax then blocks up the ear tube still more. An injudicious attempt is then made to remove the wax by introducing, perhaps, a match end, a pin head, or a pen holder, which instead of removing pushes down the wax and packs it against the tympanum; or by a sudden draught or the act of swallowing the wax is suddenly pressed upon the membrane, and loss of hearing immediately ensues, because the membrane can no longer vibrate. The removal of the wax is in some cases, especially those of long standing, somewhat difficult; but with gentle treatment and patience may finally be accomplished and the hearing fully restored. The best ordinary means for removing wax, when not badly compacted, are half a drachm of sodium carbonate dissolved in an ounce of water, applied lightly, by means of a bit of absorbent cotton or sponge attached to a suitable handle. When the wax is much compacted it may be softened by means of water, quite warm, and a syringe.

A Remarkable Boiler Explosion.

The first explosion of a stationary boiler in this city, for a period of five or six years, occurred about midnight, December 17, under decidedly peculiar circumstances.

It was a new vertical tubular boiler, which had been tested within a year to 150 pounds, and was registered at 100 pounds. It was set upon a fire box of quarter inch iron, in a newly constructed brick boiler house, in the rear of No. 123 West Twenty-sixth street.

The engineer claims that when he left the boiler that evening the water was within a few inches of the top of the boiler, the fire was dying out, and, as he intended to build a fresh fire in the morning, he opened the furnace door and closed the damper and ash pan. Wood for kindling the next day's fire was in the boiler house. On going away he fastened the outer gate with a chain and padlock.

About midnight the neighborhood was startled by an explosion, and when an examination was made, the boiler-house was found to be wrecked and the boiler gone. Two hours later it was discovered in the rear of No. 441 Sixth Avenue, something like 200 feet from where it belonged. It was unbroken, and had fallen on end after its long flight over a number of tall buildings.

As the gate which the engineer locked was found to have been tampered with, and the kindling wood was missing, it was suspected that some one had taken refuge in the boiler house, or entered it maliciously, and had fired up, leaving the furnace doors closed on going away. The two steam gauges, which fell through a skylight two blocks away, registered 70 and 80 pounds respectively.

Coal Oil in Italy.

A Naples correspondent writes to a contemporary: "It is a noteworthy fact that mineral oil similar to that of Pennsylvania has lately been pumped in the Valley Cocco, in the Abruzzi, and also at Riva-Nazzano, near Voghera, in Piedmont, and it is believed that after a few more months' digging the oil springs themselves will be found. The American mode of extracting the oil is used, and some expert Canadians are employed on the work by an Italo-French company formed at Paris. The pumps are worked by steam, and the whistle of the engine is now heard where not long ago the shepherd's pipe was the only sound that broke the silence of the valley. As long ago as 1866 some Italians were ready to seek for petroleum in these localities, but were forced to desist from want of means. An illustrious geologist has asserted that there are many valleys in Italy rich in this oil, and several specimens of native petroleum exist in the geological cabinet of the museum at Milan. Companies are being formed to prosecute this industry, which must prove very profitable, for there is a tax of 50 per cent on the American oil, and expenses of transport equal to 20 per cent. If the Italians themselves do not enter into the speculation, it is certain that strangers will not be long in doing so."

Francis T. Buckland, well known in this country and in Europe as a writer on natural history, died at his home in London on December 19, 1880, at the age of 54. He was the eldest son of the Rev. William Buckland, D.D., Dean of Westminster. He was a student of Christ Church, Oxford, where he took his B.A. degree in 1848. He inherited a strong taste for natural history and physical science, and devoted himself to the study of medicine, and in 1854 became assistant surgeon to the 2d Light Guards, retiring in 1863. He was a voluminous contributor of papers on pisciculture and physical science to the London *Times* and our excellent contemporary *Land and Water*. At his own expense he established the "Museum of Economic Fish culture," at the Royal Horticultural Gardens, and did other things for which he was publicly thanked by the Royal College of Surgeons.

THE EXPANSION OF STEAM.

BY PROF. R. H. THURSTON.

In studying the actual performance of steam engines we have seen, as was stated in the reply to the question, "What is the proper point of cut-off in steam engines to give maximum economy in dollars and cents?" that the best point of cut-off is determined by so many and such variable conditions that we can only ascertain what is the best rate of expansion by experience with each class of engine.

The experiments made many years ago by the Navy Department on various kinds of marine sidewheel engines working at moderate speed and having unjacketed cylinders, the steam pressure being 25 to 30 pounds by gauge, proved the point of cut-off giving maximum economy to be at from four-tenths to five-tenths,* and such engines are still so worked.

With the higher piston speed customary with screw engines a little greater expansion may be attained. The irregularity of wheel which is due to short cut-off is one of the retarding elements which exists in less degree in the latter case though a serious drawback in the former, so serious that many engineers would hesitate to expand more than 2½ times even with steam at 30 to 40 pounds where the engine is of long stroke like our river beam engines.

In the case of the ordinary unjacketed stationary engine with drop cut-off and a speed of about 300 times the cube root of stroke measured in feet, the best examples that I have known have expanded about 3 times, neglecting clearance, when steam was carried at 40 or 50 pounds, as was common at their first introduction, 4 times when carrying steam at 60 to 70, and about 5 times with 100 pounds of steam. For such cases I should therefore be inclined to proportion engines, when designing them, to cut-off at about $\frac{1}{2}\sqrt{P}$.

With engines of *very* high piston speed, with engines of high speed and steam jacketed, and with compound engines in which the expansion is so divided as to reduce losses by internal condensation and to make the frictional resistances less, I should make the design such as would assume an expansion of about $\frac{3}{4}\sqrt{P}$. Thus the Porter-Allen engine, the pioneer of high speed engines, may, it is said, work with maximum economy at a cut-off of about one-eighth when steam is carried at 100 pounds per gauge. Yet an engineer of great experience, Mr. D. K. Clark, puts the point of maximum economy for the single cylinder jacketed engine with steam at 55 pounds at but one-fourth, the expansion ratio for the unjacketed engine with steam at 75 being put at 3.

The best figures for compound engines are about these:

Elder & Co.'s compound marine engine, with steam at 55 to 60, expanding 3½ times, and giving a horse power for a little less than 1¾ pounds coal per hour. (Donkin's stationary engines: steam, 50 to 55, coal, about 2 pounds expansion, 13½ times, and Leavitt's pumping engine: steam, 90; expansion, 13½ times; consuming 18 pounds steam—illustrate successful practice with greater expansion.)

United States steamer Bache (Emery's design); steam, 90 pounds; expansion, 7 times; using 20½ pounds steam (or feed water) per horse power and per hour; and steamer Rush (same designer); steam, 82½; expanding 6¼ times; using 18½ pounds steam per horse power and per hour, are good cases.

In the latter case the designer concludes that it is of little advantage to carry steam pressure much above 100 pounds, and puts the economical points of cut-off at or more than one-fifth stroke for 80 pounds, and two-sevenths to one-quarter for the lower pressures used, and gives as a fair working rule for number of expansions $\frac{P \times 37}{22}$ for good single engines. He thinks this too high for ordinary engines and too low for compound, conclusions that it will be well to compare with my own.

Other such figures might be given, but these show that the best point of cut-off for engines constructed by the best builders is only known by actual experience, and is far within that which would give a terminal pressure equal to the back pressure line of the indicator diagram. Ignorance of this fact has caused the loss of many hundreds of thousands of dollars by builders and users of steam engines, who have vainly striven to secure economy of fuel by extreme expansion; and the loss due to too great expansion is usually greater than that caused by too little.

With increased piston speed and velocity of rotation, with increased efficiency of steam jackets and with increased dryness of steam, such as is obtained by superheating, we get nearer and nearer the ideal conditions of expansion, and no one can say where we may reach a final practical limit. We only know that progress is very slow in that direction, and we are still *very* far from the ideal limit.

My own conclusion is, therefore, as already stated, that engines, as they are built to-day by the best builders for marine or for mill work, with unjacketed cylinders and moderate piston speed, do their best work when expanding about one-half the square root of the steam pressure. Were I to choose the style of engine I should select the "compound" condensing engine for all work demanding very regular or very slow speed, and where a double engine has its special advantages, as in pumping or on shipboard; I would superheat moderately, steam jacket carefully—heads even more carefully than sides—and expand $\frac{1}{2}\sqrt{P}$, the latter at high speeds and with thin inserted cylinder barrel.

Where I could be confident of good work, and where a single engine might be allowable on other grounds, as in mills, I should probably select a high speed engine, steam jacket it completely, superheat 50° to 75° Fah., and expand $\frac{3}{4}\sqrt{P}$, using a condenser, where water could be had, whenever the engine was of moderate or large size.

Where compelled by limited means, or where the exceptionally low cost of fuel or other circumstances make it best to use the unjacketed cylinder and the less expensive forms of engine with drop cut-off, I would expand as in the first case above, $\frac{1}{2}\sqrt{P}$. And finally, if using the plain old-fashioned slide valve, I would set it to cut-off by the lap at three-fourths and raise the link in regular work so as to cut-off at about four-tenths or five-tenths, cushioning heavily and running fast. With that valve gear the limit is fixed, without reference to pressure, by the construction. High piston speed is of advantage in all cases where it can be adopted. Where the steam jacket becomes comparatively inefficient, as at very high rates of expansion, the remedy would be to design engines with thinner cylinders and heads, trusting to ribs for strength, and I should be inclined to use the inserted cylinder, as have some of the British makers for many years past.

The use of wrought iron or of brass cylinder linings properly secured would permit more rapid transfer of heat, and would in some cases, I have no doubt, prove of advantage. Non-conducting linings, as used by Smeaton and later by Emery could they be made to stand, would perhaps be still better.

As engines are actually built, every intelligent builder, if possessed of sufficient experience, knows pretty nearly what is the best point of cut-off for his engines, and is himself the best authority on that subject. The degree with which that point approximates to that found for a theoretically perfect set of conditions is also a true gauge of the value of his engine and all engines might be graded by this comparison. It is, perhaps, the best method of determining the economical value of any given *type* of engine under any given set of conditions.

Lecture Experiments.

COMBINING AND ILLUSTRATING THE GLOWING OF PLATINUM IN A CURRENT OF ILLUMINATING GAS WITH THE RENDERING LUMINOUS OF A BUNSEN BURNER FLAME, WHEN THE GAS IS PREVIOUSLY HEATED.

An ordinary Bunsen burner is increased in length to the extent of, say, 3 or 4 inches, by adapting a platinum tube to the upper end, of such a caliber as to snugly fit. On placing the latter in a horizontal position, and opening the cock, the ordinary flame is first obtained; thereupon, with another burner, the platinum tube is heated to bright redness, the non-luminous flame now becomes the ordinary luminous one. The change is most marked when the cock is not more than half open. Now remove the second burner and place the first upright; the platinum then begins to glow at the upper edge, which glowing soon passes down and extends nearly throughout its entire length. On closing the cock and opening, after incandescence has entirely ceased, it will again glow as before; this time, however, without flame at its extremity. C. GILBERT WHEELER.

Laboratory of the University of Chicago.

Propelling Boats Without Wheels or Screw.

Attempt has been made to propel boats on canals and rivers by conducting a column of water through a pipe and ejecting it forcibly at the stern, but it did not prove successful.

An Englishman now claims to have got over the difficulty by showing that "the force exerted by one fluid pouring into or against another depends on the contact of surfaces, and not on the sectional area of the flowing mass, after the flowing mass be once set in motion." Instead, therefore, of tubes with large orifice, he makes use of tubes with narrow outlet, a mere slit, and thus obtains a large superficial contact by ejecting water through a series of narrow openings.

New York to Philadelphia in One Hour.

The distance between New York and Philadelphia, in an air line, is 81 miles, over a comparatively level country. In a recent paper before the Franklin Institute, Mr. W. Barnet Le Van maintained that an air line road could be constructed between the two cities, on which trains could make the distance in one hour, and that the enterprise would pay. The line he proposed would cross no roads at grade, and would have but two curves of 10,000 feet radius each.

For articles of rubber which have become hard and brittle, Dr. Pol recommends the following treatment: Immerse the articles in a mixture of water of ammonia one part, and water two parts, for a time varying from a few minutes to an hour, according to the circumstances of the case. When the mixture has acted enough on the rubber it will be found to have recovered all its elasticity, smoothness, and softness.

CHIAN TURPENTINE IN CANCER.—At a recent meeting of the Medical Committee of the Middlesex Hospital, London, it was resolved that no more Chian turpentine should be ordered for the treatment of cancer, as, after a prolonged and careful trial, it had been found that its results were perfectly negative.—*Lancet.*

Durability of Rails.

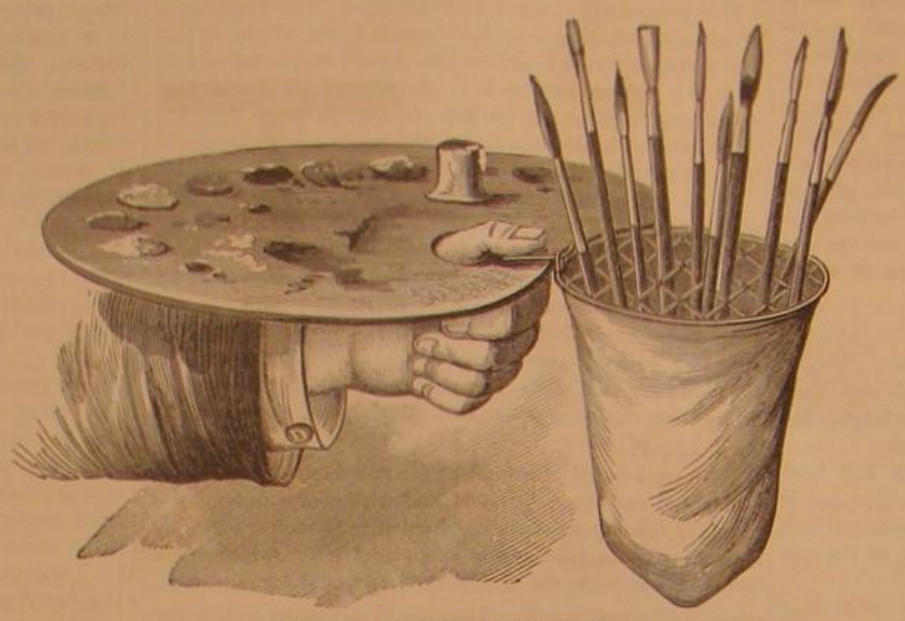
The tests of the durability of steel rails on the Great Northern Line of England, show that the hardest rails do not wear the best. In one instance a hard rail was worn away one sixteenth of an inch by a traffic amounting to 5,251,000 tons. A softer rail near by was worn the same amount by 8,402,000 tons. In another instance the total was 15,531,000 tons for a hard rail, and 31,061,000 for a soft rail, the wear and tear being the same—one-sixteenth of an inch. Analysis showed this last rail to consist of 99·475 per cent of iron and minute quantities of carbon, phosphorus, silicon, manganese, sulphur, and copper.

BRUSH HOLDER.

The engraving shows a brush holder for sustaining and keeping the brushes used by an artist while painting separate from each other, particularly when the brushes are charged with paint.

Usually the brushes are held in the hand of the artist, and often with more or less difficulty; but with this device the handles are inserted through the grid and into the bag, the grid serving to keep the heads of the brushes apart from each other.

This invention was recently patented by Edith A. Pope, of Boston, Mass.



NOVEL BRUSH HOLDER.

The Safety of Steamboat Travel.

The annual report of the Supervising Inspector General of Steam Vessels corrects the prevailing impression that last summer was uncommonly prolific in steamboat disasters. There is charged against the year but twenty-six accidents involving loss of life, against thirty-two for the year before.

During the year the total number of vessels inspected was 4,536; total number of officers licensed, 16,661. The total number of lives lost by accidents from various causes was as follows: Explosions, 22; fire, 52; collisions, 66; snags, wrecks, and sinking, 14; accidental drowning, 25; miscellaneous casualties, 6: total lives lost, 185. The report concludes as follows: "I respectfully invite attention to the small percentage of lives lost as compared with former years, when the number of passengers carried was much less. Out of perhaps 220,000,000 passengers transported on steam vessels during the last twelve months—a daily average of over 600,000—but 185 lives have been lost through causes incidental to steamboat travel, 103 of which number were passengers; and I feel warranted in asserting that the fact that only one person was lost out of every 1,100,000 persons carried argues a degree of intelligence and skill on the part of the licensed officers of steam vessels and the officers of this service unsurpassed and scarcely equaled in any other service."

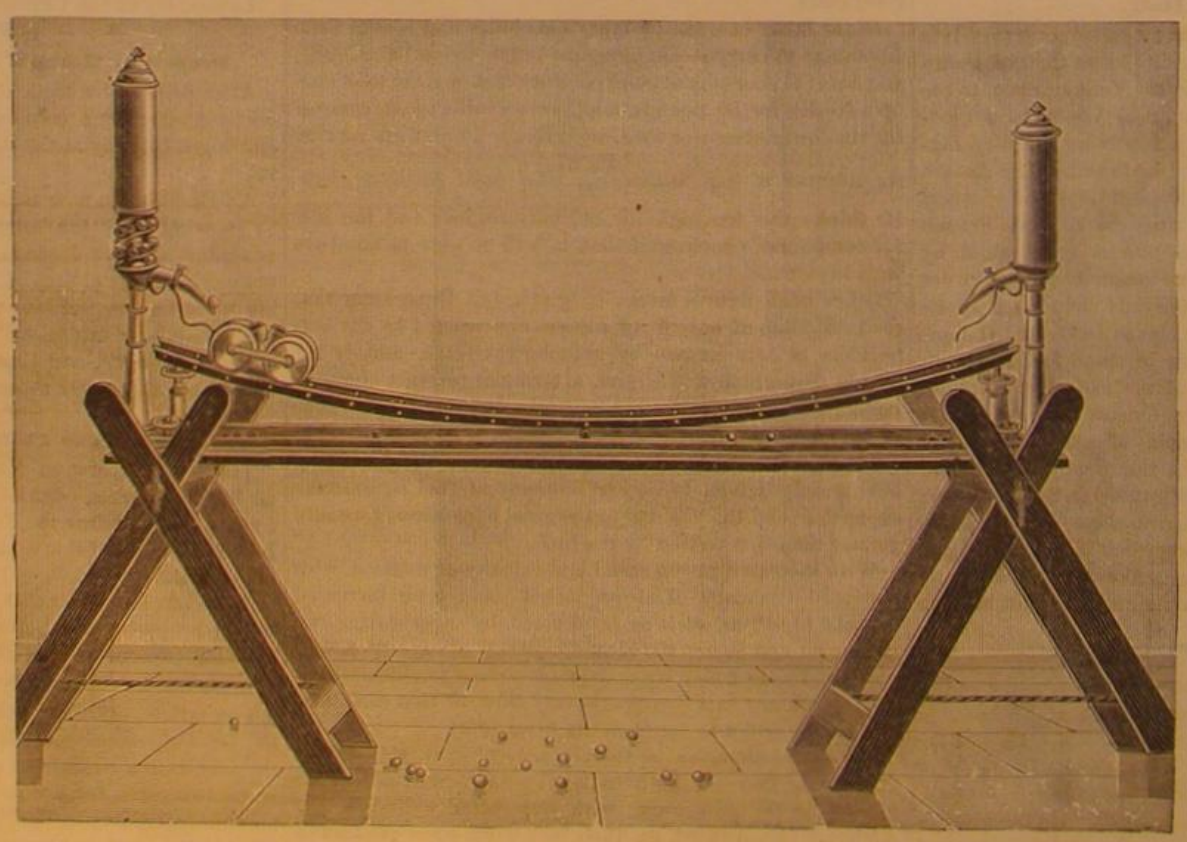
APPARATUS FOR DEMONSTRATING MECHANICAL PRINCIPLES.

An ingenious apparatus for demonstrating certain mechanical principles is shown in the accompanying engraving from *La Nature*. It is the invention of Mr. Jean Mocenigo. The curved track is about five feet long. The car carries two shallow cups designed to catch and discharge small balls of lead or other material dropped from the cylindrical reservoirs at the ends of the track.

When set free at one end of the track the car by itself descends to the bottom of the curve and is carried by its momentum part way up the opposite slope; then it returns, and continues the to-and-fro motion until brought to rest at the bottom by the combined resistance of friction and the air. The amount of this resistance is measured by means of the balls employed to keep up the oscillation of the car.

The discharge of the balls is effected by the impact of the car upon the light springs underneath the spouts at the ends of the track, one and only one ball being let go at a time. The car thus loaded runs to the bottom of the curve, where the ball is dropped, the increased momentum from the added weight just sufficing to carry the empty car to the summit of the other slope and set free another ball, by which its gravity is re-enforced for another excursion. In this way the to-and-fro movement of the car may be maintained for any length of time.

It is obvious that in one complete excursion of the car the force applied is equal to the combined weight of car and ball falling through a distance equal to the height of the end of the track above the middle; the work done is equal to the lifting of the car alone through the same distance, the ends of the track being on the same level. The difference between the power and the effect is the measure of the power consumed in overcoming friction, the resistance of the air, and the force of the spring by which the ball is discharged.



MOCENIGO'S APPARATUS.

Atlantic Cables.

The lengths of the several cables between the United States and Europe and their locations are given as follows: The three Anglo-American cables now in use run from Ireland to Newfoundland, 1,850 miles, and from Newfoundland to Sydney, over 300 miles—a total distance of about 2,150 miles each; the Anglo-French cable from Brest to Duxbury, by way of St. Pierre, is about 3,329 miles long; the Direct United States cable from Ireland to Torbay, and from Torbay to Rye Beach, 2,360 miles; and the new French cable from Brest to Louisburg, 2,430 miles, from St. Pierre to Cape Cod, 880 miles, and from Brest to Penzance, 151 miles—a total length of about 3,461 miles.

Preparations are being made for laying two new cables to be operated in connection with the land lines of the American Union Telegraph Company. They will connect with the land lines at Cape Breton, and be about 2,400 miles long.

Of the cables laid by the Anglo-American Company, the one put down in 1865 was broken March 11, 1873, and finally abandoned February 1, 1878; that laid in 1866 was broken January 13, 1877, and abandoned July 27, 1878. The latter cable, except the shore ends, was renewed last summer at a cost of £222,300; it is now called the cable of 1880. The cable laid in 1873 was broken April 2, 1879, and was repaired in the same month; it is now in operation. No break has yet occurred in the cable laid in 1874. Of the three cables now working, which were laid by the company, one has been down over six years and another over seven years. The Erlanger cable, under the management of the Anglo American Company, was laid in 1869; it was broken in the following May, and several times since the same accident has occurred. It was last repaired in August, 1879, having been broken February 22 in that year, but it was again broken last month. It is said that the cable is so rotten that no attempt to repair it will again be made.

The cable of the Direct United States Company was laid in 1874, and has been broken twice: the first time, January 4, 1879, on the ocean side near Torbay, and in February, 1879, in the Rye Beach and Torbay section. Both breaks were repaired, and the cable is said to be now in good condition. The cable of the new French Company has been down about a year. It was broken May 2, 1880, near the Island of St. Pierre, and repaired the same month; the section between Cape Cod and St. Pierre was broken November 21, 1880, and is now repairing.

ENGINEERING INVENTIONS.

An improved car coupling has been patented by Mr. William I. Ely, of Freehold, N. J. The invention consists of an open-mouthed and open top draw bar, having pivoted within it a spring-actuated hook-headed jointed coupling bar, and of the combination therewith of a stirrup fitted within the draw bar, embracing or set about the coupling bar.

Mr. John W. Carley, of Cotton Gin, Tex., has patented an improved machine for boring wells, prospecting, and mining shafts, post holes, and various other purposes where earth is to be loosened and removed. It is so constructed as to operate continuously, except while sections are being added to the shaft and belt, the earth being removed as fast as it is loosened.

Mr. John G. Herold, of Moberly, Mo., has patented an improved nut lock for railroad rail joints, by which the nuts are prevented from becoming loose and dropping by the jar of the engines and cars passing over the rails; and the invention consists of a flanged locking strip or piece with beveled underside that is fitted into the angle of the fish bar. The flange extends up between the fish bar and inner face of the nuts into the space formed by the interposed washers of the nuts, while the top of the locking strip in front of the flange is notched below the nuts for retaining the corners.

An improvement in surveying instruments has been patented by Mr. Thomas M. Jackson, of Clarksburg, West Va. The invention consists in attaching a level detachably to the body of the telescope of a plain transit instrument by means of two armed or hinged clamps whose upper or free ends are secured together by thumb and binding screws, the telescope being also provided with laterally projecting pins that indicate the proper position of the clamps and prevent it from shifting.

An improvement in baling presses has been patented by Mr. William Duke, of Longtown, Miss. The invention consists in constructing a rotating baling press with plates and rollers interposed between its friction surfaces to diminish the friction when the press is operated.

An improvement in that class of railway car trucks in which the brakes are not applied to the flanged running wheels, but to small wheels which are mounted on the axle between the truck or running wheels, has been patented by Mr. George Bressler, of Altoona, Pa.

An improved vehicle wheel has been patented by Mr. John Ladner, of Charlestown, Mass. The invention consists in constructing a vehicle wheel with friction rollers placed in a countersink in the hub, a ring oil chamber having holes in its inner wall, the plates that close the outer end of the hub, and the guard plate attached to the inner end of the hub, whereby the friction is lessened, the bearing kept lubricated, and the escape of oil and the entrance of dust are prevented.

An improved drilling machine for artesian and other wells has been patented by Mr. Patrick Sweeney, of Leadville, Colorado. The invention consists of a drum for the drill rope loosely mounted on a shaft and provided with a rising curved flange on each end and with two studs on one end, the studs engaging with a cross bar on the shaft, and the rising flanges sliding on adjustable projections of the frame, thus causing the drum to move forward and backward on the shaft, whereby it is alternately engaged with and disengaged from the cross bar, thus raising the drill and then permitting it to drop.

An improved drilling machine for artesian oil wells has been patented by Mr. Frank Knowlan, of New York city.

The construction and operation of this machine cannot be clearly described without engravings.

An improved rub-iron for car trucks has been patented by Mr. David E. Small, of York, Pa. The object of this invention is to provide an ordinary car truck with an improved rub-iron which will adapt the truck to carry either wide or narrow car bodies, or such bodies as are used upon broad or narrow gauge roads, so that the car body, with its cargo, may be transferred from the truck of a wide gauge to the truck of a narrow gauge road.

Volcanic Thunder Storms.

A paper on volcanic thunder storms, by M. Faye, was read before the French Academy of Sciences, on November 2. It is stated that in paroxysmal eruptions the enormous amount of steam ejected causes volcanic thunder storms, which are very different from ordinary thunder storms. The volcanic storm has no gyratory movement; it is confined to the column of ascending clouds, and no flashes occur without the presence of ashes. Altogether, the phenomena resemble very closely those of the Armstrong electric machine. As observers have failed to mention any hail attending these thunder storms, it is probably because no hail is formed. Its absence is due, M. Faye thinks, to the lack of gyratory motion already noticed.

TIDAL OUTLETS FOR SEWERS.

On this page we show a plan from Mr. Rawlinson's "Suggestions" for a main sewer outlet to the sea, or to a tidal estuary on a flat shore.

The object sought to be attained by this plan is to permit the rise and fall of the tide in such a manner as not to disturb the flow of sewage, or drive back sewer gases during windy weather or during the rising of the tides.

In Mr. Rawlinson's plan, the sewer is much smaller than many outlet sewers, being oviform, 3 x 2 feet, with an area of 4·594 square feet, equivalent to a circle of 1·654 feet diameter.

The main is carried to a man hole chamber, at which a flap valve is placed over the inlet. There are two outlets, one from the bottom by an 18-inch cast iron pipe, leading to a point below low water, and terminating in a bell-shaped end opening downward, the other from the high water level by a 24 inch pipe of cast iron, so constructed as to discharge between high and low water mark.

The man-hole chamber is ventilated at the top.

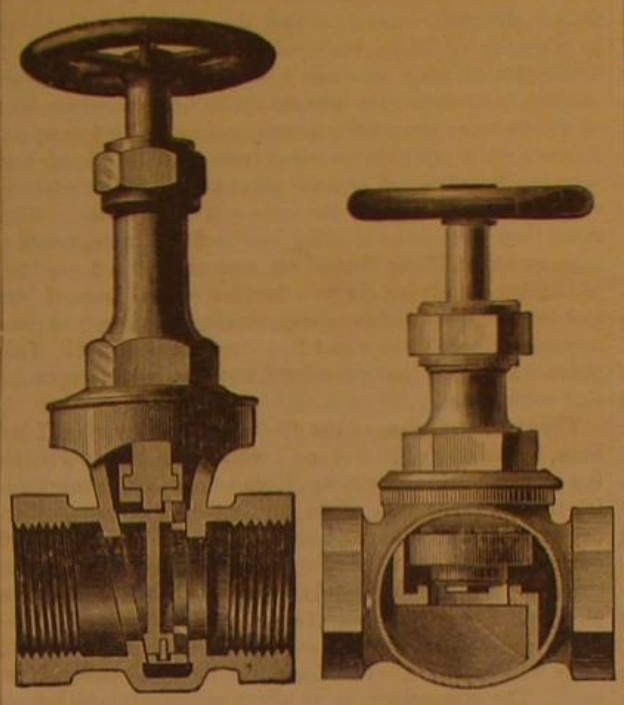
At some distance back from the chamber an 18-inch cast iron pipe is led from the bottom of the sewer to the bottom of the man-hole chamber, which is above low water mark. It is there trapped, so as to prevent the passage of air if the pipe is not running full.

This pipe is intended to carry off the dry weather flow of the sewer without opening the flap at the chamber inlet, and thus allowing the entrance of wind from the outlet. A ventilated man-hole is placed over the upper end of the pipe.

This is, upon the whole, a neat arrangement. Its chief defect, if it can be called a defect, is in the reliance upon a flap valve. All automatic appliances are rather unsafe in a sewer, being liable to be clogged and their action impeded by the slime and foreign material, which cannot be prevented from entering the sewer. In this case the flap seems altogether useless, for the flood-water overflow, which is the only inlet for wind at the seaward end, might just as well be carried to low water level, and seated in the same manner as the low water outlet.—*The Plumber and Sanitary Engineer.*

JENKINS' PACKING AND VALVES.

The engraving shows two forms of valve patented by the late Nathaniel Jenkins, and now a well known standard article familiar to manufacturers and steam engineers throughout the country. These valves are provided with disks of Jenkins' compressible packing instead of the usual metallic surface. This packing has been in every-day use for twelve years, and has been indorsed by first-class engineers and mechanics throughout the country. It is found to



JENKINS' IMPROVED VALVES.

render the valve perfectly tight under all pressures of steam, oil, or gas, and it is not injured by sand or grit, nor will foreign substances lodged between the valve and seat prevent it from closing.

Should it become necessary to repair one of these valves it need not be removed from its place, as the disk can be replaced in a few minutes, at a small cost, and without the aid of a mechanic. No regrinding is required as in other valves.

The improved packing is applied to various purposes, and is largely used by our best engineers and manufacturers. It is made up in sheets, gaskets, rings, and washers, and when used in a joint subjected to steam or heat it hardens, forming a body which, the manufacturers claim, will last for years, as it does not burn out or decay, and if care is taken, the joints may be often broken without injury to the packing. The same material is also made up into pump valves, which, we are informed, have given general satisfaction, being especially desirable on account of its heat-resisting qualities. It is used in pumps for handling oils and acids, and may be used where rubber valves have failed, a special form of the packing made which is adapted to valve stems rendering the stuffing boxes steam and water tight.

Messrs. Jenkins Brothers, of No. 11 Dey street, New York city, and 104 Sudbury street, Boston, may be addressed for further information in regard to these inventions.

AGRICULTURAL INVENTIONS.

Mr. William H. Ryer, of La Crosse, Wis., has patented an improvement in sulky plows. This invention consists in the mechanism for raising and lowering the plow upon the frame, and in certain other features of construction, which cannot be described without engravings.

Mr. George W. Fink, of Pleasant Plains, Ill., has patented an improvement in that class of check row seed planters in which the seed-dropping mechanism is actuated by a rope stretched across the field; and has for its object to simplify the construction, lessen the weight, and increase the reliability of the seed-dropping mechanism.

A combined listing plow and seed planter, patented by Messrs. Leonard A. Cooper and Oliver F. Bostwick, of Atchison, Kan., is so constructed as to open the ridge or clear a space for the row of hills, open a furrow to receive the seed, drop the seed, cover the seed, and roll down the soil.

Messrs. Richard E. Caviness and George McCormick, of Beckwith, Iowa, have patented a check-row corn planter of the kind that is operated to drop the seed by a line stretched across the field.

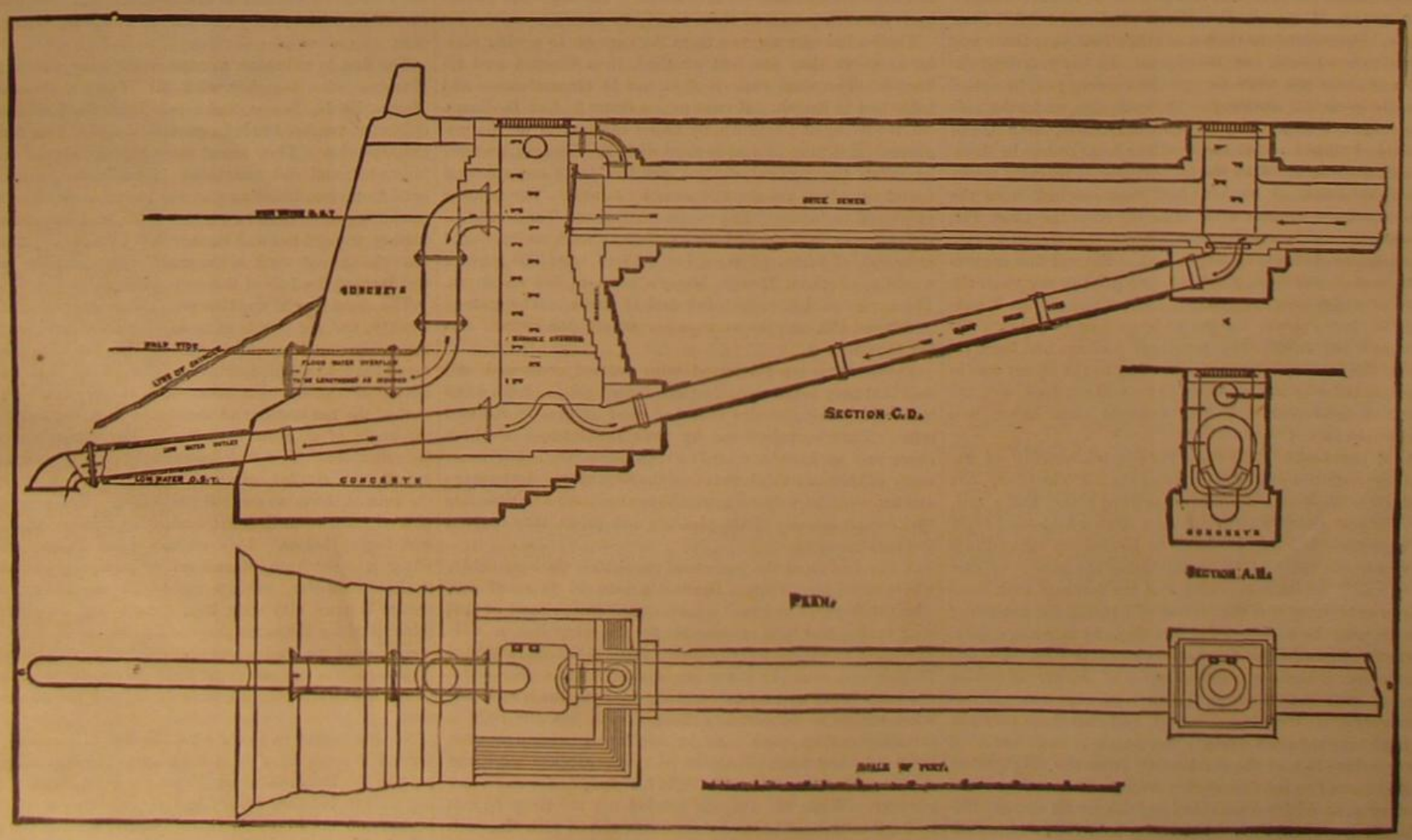
An improved cockle mill, for separating cockle and other small seeds from wheat, has been patented by Mr. James M. King, of Walnut Station, Minn. It is simple in construction and effective in operation.

Mr. George C. Winslow, of Kalamazoo, Mich., has patented an improved harrow and cultivator tooth which is not only yielding to obstructions, but one capable of adjustment for greater or less tension, as well as adjustable to greater or less depth and inclination.

The "Frigate" Mackerel.

A notable event in the history of our coast fisheries was the sudden appearance, last summer, of the "frigate" mackerel in immense schools about Block Island and the adjacent waters. These fish are very common about the Bermudas, the Azores, and on the coast of Europe, but were never before seen in the waters of the United States. It was estimated that many of the schools in the vicinity of Block Island contained from 80,000 to 100,000 fish each. Considerable quantities of the fish were taken, but they were found in small demand as a table fish. They will probably prove valuable chiefly for the oil which they contain, and for use as a fertilizer.

Beatty's Organ Factory.



SEWER OUTLET ON TIDAL RIVER OR SEA SHORE.

THE ALBION COAL MINES.

BY H. C. HOVEY.

The series of startling disasters by which these famous mines have lately been overwhelmed with loss, and perhaps with utter ruin, serves to recall a memorable visit I made to these same collieries only three months ago. They are worth describing, independently of the painful interest awakened by recent distressing events.

The Albion Mines are located in Pictou County, in the province of Nova Scotia, about 100 miles north of Halifax, and one mile from the village of Stellarton. The entire coal field of the province, so far as explored, occupies an area of about 685 square miles; but the portion lying in Pictou County is a basin by itself, irregular in form, inclosed by much older geological formations, and covers only some 35 square miles. Although thus limited in extent, as compared with other fields, it possesses great value on account of the extraordinary thickness of its beds. According to Hon. Mr. Gilpin, Inspector of Mines for Nova Scotia, to whom I am indebted for much of my information, as well as for personal attentions, the section of measures in the district of the Albion Mines has a vertical thickness of 2,450 feet, holding 100 feet of coal, lying at an angle of 18 degrees.

The group on the western side of East River exists in several seams of varying thickness and quality. Those most extensively worked are known as the deep seam, which is reached by the "Cage Pit," and the main seam, pierced by the "Foord Pit." The deep seam is nearly 23 feet thick; the main seam actually attains the enormous thickness of 35 feet, although the portion worked does not exceed 22 feet. I was conducted to a spot where the workmen had cut through the entire seam and had taken out a section 35 feet high for exhibition in the Provincial House at Halifax, where I afterward had opportunity to verify the statement by actual measurement. For 22 feet it is clear coal, without a particle of foreign material that I could discover; and the balance has only here and there an intruding stratum of slate or clay.

It should be stated that all the coal thus far found in Nova Scotia is of the bituminous variety; no anthracite having yet been discovered. It has much firmness, however, and though burning freely does not readily slack or crumble. These qualities make it a favorite steam coal on the Atlantic and other steamers. It has also been extensively used for domestic purposes, and it is admirably suitable for coking. Large quantities were formerly exported to the United States for gas making. Analyses made by the London Gas Company, in 1879, gave 10,300 cubic feet of candle power gas, and 14 cwt. 2 qrs. of good coke per ton of coal. The gas is also represented as remarkably free from sulphur and other deleterious ingredients, when the purifiers were attended to.

These mines were formerly owned by the General Mining Association, of England, which also owned other mines in the Provinces; but a few years ago they sold out to what is known as the Halifax Mining Company, chiefly, however, London capitalists. The Acadia Company, working what is regarded as an extension of the main seam at Westville, is the only American company in the region. Some idea of the importance of this field may be had from the official statement that the area of the Halifax Company alone contains 67,365,000 tons of available coal. The entire coal produce of Nova Scotia for 1879 was reported to be 788,271 tons; of which aggregate the Albion Mines produced 171,534 tons, being a larger quantity than was taken that year from any other single mine in the Dominion. In the year 1862 the yield was about 200,000 tons, and the current year promised to exceed even that showing. The company, under the able management of Superintendent James Hudson, has a line of steamers of their own, and were filling large orders in Montreal and elsewhere. With the improvements recently made, a daily extraction of 500 tons had been reached from the Foord Pit alone, besides what came up from the Cage Pit; and other enterprises were under contract that would operate to increase even this very large yield. Several fine engines had been sent over from England, just prior to my visit, the design of which was to introduce compressed air as a substitute for horse power on the underground railways. To facilitate work further the principal inclines had been regraded. In fine, everything pertaining to the mines was in as perfect order as human ingenuity could compass; and the terrible disaster that now has wrought such havoc was wholly unexpected.

The upper works of the Cage Pit present nothing of unusual interest; but after descending a shaft 300 feet deep, one is led to the head of a wonderful inclined plane, half a mile long, up and down which cars are drawn by a steel rope. The rope itself is a heavy load to be hauled up many times a day, without taking into consideration the string of cars full of coal. Another curiosity that the foreman took some pride in exhibiting was the system of lighting the portion of the mine near the engine. This was done by utilizing a natural supply of gas flowing from a crevice in the wall. I asked the question, if there was not a degree of danger attending this; but was reassured on being told that the gas was thoroughly headed up in a reservoir, and that those very jets had been burning *seven years*. Yet when tidings came of the explosions in and flames issuing from the neighboring pit, it occurred to me that such a steady stream of gas as I saw must proceed from a hidden and dangerous source. Undoubtedly it was so, though there may have been no immediate connection between those pretty jets and that destructive conflagration.

Before entering the Foord Pit I gave some time to an examination of the works above ground. In doing so I had the company of Mr. Gilpin and Mr. Joseph Hudson (the son of the superintendent). They showed me the old engine "Hercules," the first locomotive run on any railroad in British America. It was still in use; and the man who ran it on its trial trip, so long ago, is still employed by the company. A duplicate engine of the same age, called the "Samson," stood on a side track near by, in good repair and daily use. In proximity to these antiquated affairs was one of the latest and most highly improved English locomotives; the contrast furnishing an instructive object lesson in the progress of modern mechanism.

We found the patriarchal engineer himself at his post of duty in the pump house, running the gigantic steam pump by whose powerful strokes a volume of water is continually discharged as large as a man's body. The buckets, about two feet in diameter, are brought up in three successive lifts of a little more than 300 feet each, making 1,000 feet in all. At the time of my visit the water from the old workings had been nearly exhausted, and the great pump was relied on to raise the water from both the main and deep seams. Who could then foresee the bursting in of a flood in September, from an old and long disused pit, and another on the 12th of October, drowning six men besides several horses? Or that later explosion of fire-damp, making it necessary to pour *into* the mine all the water that could be obtained? This pump was at that time considered equal to all emergencies that might arise.

The ventilating fan, of the Guibal pattern, having, I believe, a diameter of 30 feet and a width of 10, was in a building by itself, and was run by steam acting on a crank turning the fan at the rate of 40 revolutions a minute, with a capacity of 50 or more, and drawing from 65,000 to 70,000 cubic feet of air from the mine. So strong was the suction that ingress to the fan house could be had only through an air-lock. The object was twofold, to withdraw inflammable gases from the pit, and to supply the men working there with fresh air. The Cage Pit is ventilated by a furnace. The atmosphere, as we afterward ascertained, is kept as pure as could be desired by either method under ordinary circumstances.

The actual conveyance of the current thus forced underground to the places where it is most needed is by shutting off the old passages not now worked by brattices or thin partitions toward the working faces, and in many cases by air-proof cloth curtains hung in such a manner as to guide the current, even to the extent of splitting it and making the sub-currents travel in opposite directions. But, as recent events have shown, the best precautions cannot prevent the sudden release, at times, of hidden magazines of explosive material stored up in the coal, which by superior force overpower the ventilation, and, as in the Albion disaster, destroy the fan itself, hurling its fragments to a distance and demolishing the building covering it.

The original method of entering the mine was, of course, by the inclined plane, through which the horses are still let in; but the drawing arrangements of the colliery at present are clustered around a pit, and the coal is drawn to the surface in cages. The cage is an open framework of steel bars holding a double deck, two trams being carried on each deck. It is raised by a steel rope fastened to the top bar; and while one cage is lifted another is lowered. The cages are guided by vertical rails to hold them steady in passage.

The loaded cars are run from the cage on to a wide platform, where they are first weighed, then dumped and returned. The steel rope is 6 inches in circumference and 1,200 feet in length. It runs over a drum 22 feet in diameter, revolving at a rate wholly under the control of the engineer. Entering an empty cage with Mr. Hudson, we were let down the vertical shaft, 1,000 feet in 70 seconds, and found ourselves among the swarthy miners. The number employed varies according to circumstances. The published statement in 1879 showed the number at work underground to be 384, of whom 84 were boys; there were 200 surface workers, of whom 37 were boys; a total of 584 employes. The horses used were 38 below and 17 above. The cutters numbered 259, and the average per cutter per annum was 662 tons of coal.

Those whom we conversed with seemed contented, and said that they made a comfortable living, getting from $1.25 to $1.75 per day, besides rent and fuel at greatly reduced rates. They surprised me by their intelligence, of which there was at least one ready explanation, viz., they were, many of them, faithful readers of the SCIENTIFIC AMERICAN; and some of the very men who have since met a terrible fate spoke most warmly of the pleasure and profit they derived from its contents.

A few feet from the bottom of the shaft is the lamp cabin, where stood Mr. William Dunbar, a man 70 years of age, who for 40 years had been a miner, and during most of that long period had been responsible for the safety lamps. He explained to me the improvements made in the old-fashioned Davy lamps, whereby the gauze is protected by a glass cylinder from being overheated, and the construction is such that when the air is dangerously charged with gas, the light is infallibly extinguished. As an additional precaution each lamp is locked when given out, so that a careless workman cannot get at the blaze to light his pipe, or for any other purpose. When Mr. Dunbar handed me my lamp he was in fine health, and boasted that mining agreed with him well. It pains me to see it stated that the fine old man is among the victims. He was in his cabin as usual, at the time of the explosion, dealing out lamps to the men, when the flames burst in at his back door. He rushed out the front door and fell on his face. His oil-soaked garments instantly caught fire, and though by his own efforts and the aid of others he finally extinguished them, it was not until he was so badly burned as to be beyond recovery.

My guide and I traveled around in the mine for what he said was about six miles; finding, of course, considerable sameness of scenery, yet seeing many things novel to one more used to exploring natural caverns than such artificial excavations. My main anxiety was to keep from being run over by the horses which went at full trot through the darkness as fearlessly as if above ground. Their stables were below, but extensive and comfortable; and the horses were seldom taken to the surface, except in case of sickness, till they died. At the time of the explosion 17 horses were found dead in their stalls. Suffice it to say that our trip was without accident.

The only indication of the presence of deleterious gas observed by us was an occasional hissing sound, like the singing of a teakettle, caused, as we perceived, by leakage of gas through fissures in the seam, but not in quantity sufficient to make an explosive mixture before being carried off by the current of ventilation. Everything seemed as safe as could be desired. No serious accident has occurred since the great fire of 1861, when the East River had to be turned into the mine to extinguish the flames.

In order to an understanding of the late calamity, some idea should be given of the method of working the field. The entire excavation, judging from the official survey I saw in the possession of Mr. Hudson, must equal 100 miles; and the tramways alone extend for about 20 miles. There is also an underground connection between the Foord Pit and the Cage Pit, as a workman told me who had gone through it. Most of these workings are now abandoned and closed up by masonry. The system adopted is a form of pillar-working, ribs of solid coal being left between the "bords," or openings at right angles with the main or gate level; and these again are intersected by bords parallel to the main level. The result when spread on a chart looks like an irregular checker-board. The side passages are usually at a steep slope from the main level, and advantage is taken of this to arrange for delivering the coal to the tramways by a system of counter balances, the full cars as they run down carrying the empty ones up to the place where the coal is being cut. The pillars vary from 16 to 18 feet in thickness, and the bords are about 20 feet wide; hence it is evident that, as mining proceeds, only about one-half the coal in the field is removed, the remainder being left as a support for the roof. The custom of "robbing the mine" has not here been introduced; by which is meant taking out the pillars, one at a time, and letting the roof fall to the floor. The practice is attended with some danger, and also shuts off access to portions of the field lying beyond the passages thus closed.

The Foord Pit is divided into the north and the south stope; the one to the north extending for a mile and three-quarters, and the south stope for more than a mile, numerous bords being worked in each. The explosion of November 12 took place in the south portion, at half-past six o'clock A.M., when 150 men had just begun their day's labor. At first it was supposed that this entire number had been destroyed; but those in the north stope escaped uninjured, and the number of the lost as last reported was thought not to exceed 50 men and boys, of whom, however, 33 are married men.

The first to volunteer to explore the mine was Mr. Joseph Hudson, who, together with Mr. Tupper, overman, and Messrs. Poole, Greene, and others from the Acadia and Vale collieries, ventured in for a quarter of a mile, four hours after the explosion. They found the stoppings on the south side blown off, and did something to facilitate ventilation, but peril from accumulating gas was too great to allow of their remaining more than two hours or so, and they came to the surface at noon to await further developments. At the same time the men at work in the north stope came up to dinner and learned the fate of their companions.

The alarm spread until the mines were stopped in all Pictou County, and the people came in crowds about the pit. Attempts to flood the mine during the day were made, and many thought the danger over. But at 10 P.M. an explosion more violent than ever shook the ground, tore off the roof of the fan house, and the descending fragments riddled the roofs of adjacent buildings. The report was heard a long distance. This was followed by another explosion at 2 A.M., and similar outbursts were repeated at intervals till the ruin of the mine seemed inevitable. Volumes of smoke poured forth from the shafts, showing what a conflagration was raging below. Fire engines from Pictou and New Glasgow were brought and set to pumping water into the shafts. Men were set to work to fill the main shaft with spruce boughs, clay sods, hay, etc., to stop the air from the mine; and for the same purpose the shafts of the Cage Pit were closed up, and orifices into old mines in the vicinity. A trench was opened from East River to the fan shaft, through which it was hoped to extinguish the subterranean fires.

No one seems to know how the fire originated, though several theories have been suggested. In Mr. Gilpin's report on the Department of Mines for 1879, he gave a warning note to increase the systematic ventilation of the collieries, and not to reason that "because fire-damp is present only in traces a very slight circulation of air is all that is required." He also points out the defects of the kinds of

safety-lamps in general use. But the mystery of the calamity at the Albion Mines is that every precaution imaginable seems to have been taken, and all the machinery made after the best patterns, and yet in vain. The deposit of coal is too valuable to be abandoned, being one of the finest in the world, and it is probable that at some time operations will be resumed. But it is certain that this cannot be done for a long time to come.

Meanwhile there are left to the charity of the public, it is said, "33 widows, 110 orphans, and 700 men, representing a population of 2,000 people, thrown out of employment in the face of a Canadian winter." An appeal on their behalf has been sent out by the managers of Nova Scotia mines, clergymen, and others. The case is certainly one that calls for an immediate and generous expression of popular sympathy.

AMERICAN INDUSTRIES.—No. 64.

THE MANUFACTURE OF BOLTS AND NUTS.

Perhaps there is no other one cause so potential for the cheapening of production nowadays as the minute division of labor carried out in every leading branch of manufacture. And the cost of making is not only thereby greatly reduced, but the quality of the product is improved in yet greater proportion. The industry which forms the subject of the first page illustrations in this paper affords a conspicuous example of this course of development in modern manufactures. There is hardly a large manufacturing establishment or a respectable machine shop in the country which has not the available facilities for forging bolts, turning screws, or making nuts, yet it is comparatively seldom that one of either of these is made by the mechanics who put them in their machines or the manufacturers who use them in a thousand different articles of which they form an indispensable part. The reason is obvious: the manufacturer who has constituted this his especial business can not only make them far better than an ordinary mechanic, but so much cheaper that it seems like wasting time to do even trifling work of this kind in a general machine shop, the ready-made bolts and nuts being of such uniform good quality that a flaw or a weak spot can rarely be found in them, and of almost every desired size required for use in all kinds of work.

It is now nearly forty years since two of the present proprietors of the great bolt and nut factory of Russell, Burdsall & Ward, commenced business in this line, at a point on the Byram river just within the Connecticut State line, about two miles from the village of Port Chester, N. Y., and twenty-five miles from New York city. The site selected was one of romantic beauty, in a picturesquely wooded dell, but their location here was for the purpose of utilizing the water power which over forty feet fall in the Byram river afforded. The contrast between their business of thirty-five years ago and its extent to day is well illustrated by the two views, which show their factory as it was then and is now. Then one horse and wagon was sufficient for the bringing of all their iron and the shipping of all their products from Port Chester, and every detail of the work not only received the personal attention of the proprietors, but the most important portions were the results of their own skill and handicraft. Even greater, however, than the difference in the amount of business, is the contrast between the way of making bolts and nuts at the commencement of their manufacture and that which is followed to-day, the many elaborate machines now used producing results which were hardly imagined possible at that day, and a large proportion of these machines, either in all their parts or in important improvements, being the invention of members of the firm.

The iron used is received in the form of bars or rods, both square and round, and in great hanks or coils, a large stock being always kept on hand. Iron only is worked here, and a considerable proportion of the goods are made from the best charcoal iron. In the main bolt making room, shown at the bottom of the page, there is probably as great a variety of machines for making bolts, and the capacity for as large a production, as can be found in any single establishment in the world. Nearly all the iron is worked cold, an improvement which has, within a few years past, been finding steadily increased favor, from the great additional strength which this manner of working gives to the goods, as against the former method of making all the blanks by the old-fashioned method of forging. Care is necessary, of course, that a bar of cold iron be not submitted to too many manipulations, but there is never any danger of this kind in the methodical operations of bolt making, where every blow the iron receives, and every time it is to be submitted to pressure, are accurately determined before the commencement of the work. The increase in strength in bolts, from working the metal cold, is estimated at between 50 and 100 per cent, and the effect in general is to give the iron a good deal of the qualities of hard steel.

For this cold working, however, powerful machines are necessary, as every portion of the labor of forming the iron is done by them, the labor of the hands being confined almost exclusively to the feeding of the machines. There are different patterns of machines here for doing the same work, but in the making of a blank for a bolt, either the wire or rod is fed into the machine so as to pass between a pair of feed rolls, which hold the metal by friction, and convey it into a steel tube or die in the central part of the machine, where the length of the bolt is accurately determined by an adjustable gauge, and is cut off in lengths sufficient to allow enough surplus metal for the forming of the pattern of head the bolt is to receive. As it is cut off it is grasped between fingers and carried to the opposite end of the die, where it is pushed back into a hole having the form of the bolt head, where a hammer strikes it and forces the surplus stock into the desired shape, after which the blank is driven from the die and drops into a box beneath.

When these blanks so headed are of square iron, they are taken to another machine, where they are suspended by their heads in a long row, between two parallel tines, from which they feed themselves into the machine, where they are grasped, one at a time, by fingers, and each one is held between the jaws of powerful revolving cam formers, being advanced and withdrawn three or four times, until the square iron is perfectly rounded, either entirely up to the head or so as to leave a square shank. The fingers then drop the rounded blank to one side, and, reaching back, pick up another one, to go through the same operation, the whole process impressing one with the idea that the machine is almost possessed of reasoning powers, so careful, deliberate, and intelligent seems to be its imitation of the motions which a workman would go through in performing a similar part of the work.

The forming of the point and the cutting of the thread are done by other machines, in which are the same feeding device and similar automatic working, these operations, however, sometimes requiring two machines, while for some goods only one operation is necessary. When the blank is fed into the jaws, which seize the end bearing the head, it is advanced against a tool which forms the point, if that part is to be completed here, and, this work being done, the blank is then passed to a chasing tool, which cuts the thread as in an engine lathe, varying the number of cuts to the size and the amount of metal to be removed. This machine, as also the blank formers and headers, are so arranged as to guard against accidents as completely as if they were possessed of intelligence. If any one part ceases to operate, or to properly fulfill its functions, the machines will stop of themselves, or have self-adjusting contrivances to remedy the difficulty; if the blanks are too long or too short they cannot be worked, and if too great strain is brought on any part, from any displacement of the machinery or the introduction of foreign matter, the machine stops and makes a noise readily distinguished from that caused by regular working.

The above describes the main features of all the bolt-making machines, although, from the great variety of goods made here, no less than from the many improvements which have been successively introduced by the firm, there are many differences in the details of the operations in swaging and finishing. All of the work, however, is performed by machines which work automatically, and some of the machines here for forming particular patterns of bolts are different from those in use anywhere else. The firm have a large machine shop, in which they make their own machinery, and besides several patents which Mr. Ward has obtained, they have made other improvements, not patented, more especially valuable in the making of goods of which they have the almost exclusive production.

In the nut-forging shop, represented in one of the illustrations, the bars are heated, the workman keeping one bar in the forge fire while he feeds the heated end of another into the jaws of a machine which cuts off the required length and punches it, while at the same time the nut is formed by hammers striking it rapidly on the bottom, top, and sides, to compress the metal and give the nuts the desired shape. This machine works very rapidly, and the goods are certain to be perfectly uniform in quality and shape, whether the nuts are square, hexagonal, or any other form.

The packing room, represented in one of the views, occupies a large department, for here are put up in paper boxes each day no less than 125,000 bolts and nuts of the smaller sizes, the larger ones being generally shipped in bulk. This work is done principally by girls, who, in long practice, acquire a degree of manual dexterity in this part of the work which is surprising to any one who has not previously noted the results of such training.

It would be impossible to enumerate, in anything less than an elaborate catalogue, the number of different kinds and patterns of bolts and nuts made at this establishment. Every standard article in this line forms a part of their regular production, in all the lengths and sizes ordinarily used. A large business has been done from the first in carriage, tire, and sleigh bolts of every description known to the trade; stove bolts are made in large quantities; plow bolts are an important specialty, and bolts for mowing machines, cultivators, and elevators, with nearly all kinds of machine bolts, knob screws, etc., are a portion of the staple goods regularly manufactured. Besides these, however, the firm do a large business in the making of special sizes and lengths, to order, for use in particular departments of manufacture, their long experience, and the high quality of their goods, which it has always been their first care to maintain, giving them special advantages for filling the large trade of this kind which comes to them.

The Library Hall is a building erected by the firm for the purpose of affording their employes better opportunities of self-culture. It contains a choicely selected library of about 2,000 volumes, and the scientific portion of the books were chosen by Prof. Youmans with especial reference to the needs of such a class of working readers. There is here, also, a warmed and lighted room, intended to make a comfortable place in which the hands can profitably and pleasantly pass their spare hours. No intoxicating liquors are to be had within two miles of the establishment, and it is the design of the proprietors to make the surroundings of those who live in the immediate neighborhood, and who earn their living there, so pleasant that there will never be any call from their hands for a place where liquor can be bought.

The firm have no city warehouse, but do all their business from the factory at Port Chester, N. Y., where the partners reside and give their personal attention unremittingly to the work of the establishment.

DECISIONS RELATING TO PATENTS.

Supreme Court of the United States.

BALL *et al. vs.* LANGLES *et al.*

1. Reissued letters patent No. 4,026, granted to Hosea Ball, June 14, 1870, for an improvement in ovens, declared to be invalid, it being for a different invention from that covered by the original patent.

2. The Commissioner of Patents is invested by law with authority to determine whether surrendered patents are invalid by reason of defective or insufficient specifications or by reason of the patentee's claiming as his own invention or discovery more than he had a right to claim as new, and whether these errors have arisen by inadvertence, accident, or mistake, and without fraudulent intention. His decision as to the existence of these prerequisites is conclusive, and not subject to review by the courts.

3. The Commissioner, however, has no authority to grant a reissue embracing new matter or a broader invention than what was revealed in the original specifications, drawings, or models.

4. The question of identity of invention is to be determined by an inspection of the two instruments.

5. Where an original patent described an interior baking chamber as provided with perforations in its sides and back, whereby its interior had communication with the fire space only *indirectly* through side and back flues, *Held*, that a reissue removing the restriction as to the location of the perforations, so that the interior of the chamber may communicate *directly* or *indirectly* with the fire space, is void for containing a different invention.

Appeal from the Circuit Court of the United States for the District of Louisiana.

Mr. Justice Strong delivered the opinion of the court.

We cannot doubt, says the court, that the purpose of the reissue was not to cure defects in the original specification, or any deficiency in describing the invention, but to cover other devices which the patentee had not in mind when he first applied for his patent, and which may have subsequently come to his knowledge. Thirteen years after the patent was granted had elapsed before he applied for any reissue. However this may be, the reissued letters are so clearly for a different invention from that for which the patentee first applied, containing new matter, and so much broader, that we are constrained to hold that the Commissioner of Patents had no authority to grant them, and consequently that they are void.

The complainants' bill was, therefore, rightly dismissed, and the decree of the court below is affirmed, with costs.

Large Telegraph Wires.

At the recent meeting of the American Electrical Society in Chicago, Col. C. H. Wilson read a paper on the use of large telegraph wires. He held that the employment of large gauge wires for the quadruplex circuit was an advantage. A No. 4 wire recently laid between New York and St. Louis, was giving entire satisfaction. The question had been raised whether, in the desire to increase the conductivity of the wires, there was any limit to their size. There was a limit, and the conductivity could be increased by employing different conductors, copper instead of iron wire, for instance.

In a discussion which followed, Mr. Somers advocated the use of large wires, and said that their employment had simplified the quadruplex problem.

Phosphor Bronze Telegraph Wires.

M. E. Bède, formerly Professor at the Liége University, has recommended the use of phosphor brouze for wires instead of iron, phosphor bronze having four times the conductibility of iron, and being from three to four times as strong as steel. Aerial lines had the advantage of being easily inspected, but the disadvantage of being liable to accident, while underground lines were almost free from accident, but difficult of inspection. That inventor would render great service to telephonic communication who should devise a cheap method of constructing underground lines, that should at the same time permit of easy and complete inspection.

Lard Butter.

The success of butter made from beef fat (oleomargarine butter) has led to the use in Chicago of pork fat or lard for the same purpose. It has been reported that large quantities of this fraudulent butter have been shipped to England, seriously injuring the market for genuine American butter. The report is disputed by exporters, though it is admitted that sample lots have been sent by New York and Chicago dealers. Obviously if lard butter is wholesome and of good flavor it can be sold on its merits; if bad it should not be sold at all. In either case its sale as genuine butter would be a fraud and should be prevented.

IMPROVED HAND AND BENCH VISE.

The tool shown in the annexed engraving is especially adapted to the use of mechanics, inventors, jewelers, and amateurs, and it may be either used as a hand vise or bench vise. The jaws may be thrown by a single movement into any desired angle. As a chuck for the lathe or bit stock, it will hold drills, awls, bits, turning tools, etc. It may also be used as a wrench which is capable of being turned in any position. Pattern makers and metal workers will find it very convenient for holding scrapers, stubs of files, and cutting tools.

The front jaw has a tubular stock at right angles to the face of the jaw; in this the bar of the back jaw slides, and is prevented from turning by a slot and feather. The screw that moves the jaws turns in the tubular stock. A clamping eye surrounds the stock, and receives a screw which presses against a follower in the eye, and clamps the stock in any position in which it may be placed in the clamping eye. The clamping screw is forged in one piece, with the ferrule at the end of the handle by which the vise is held. The clamping stand, by means of which the vise is secured to a bench, is shown in Fig. 3.

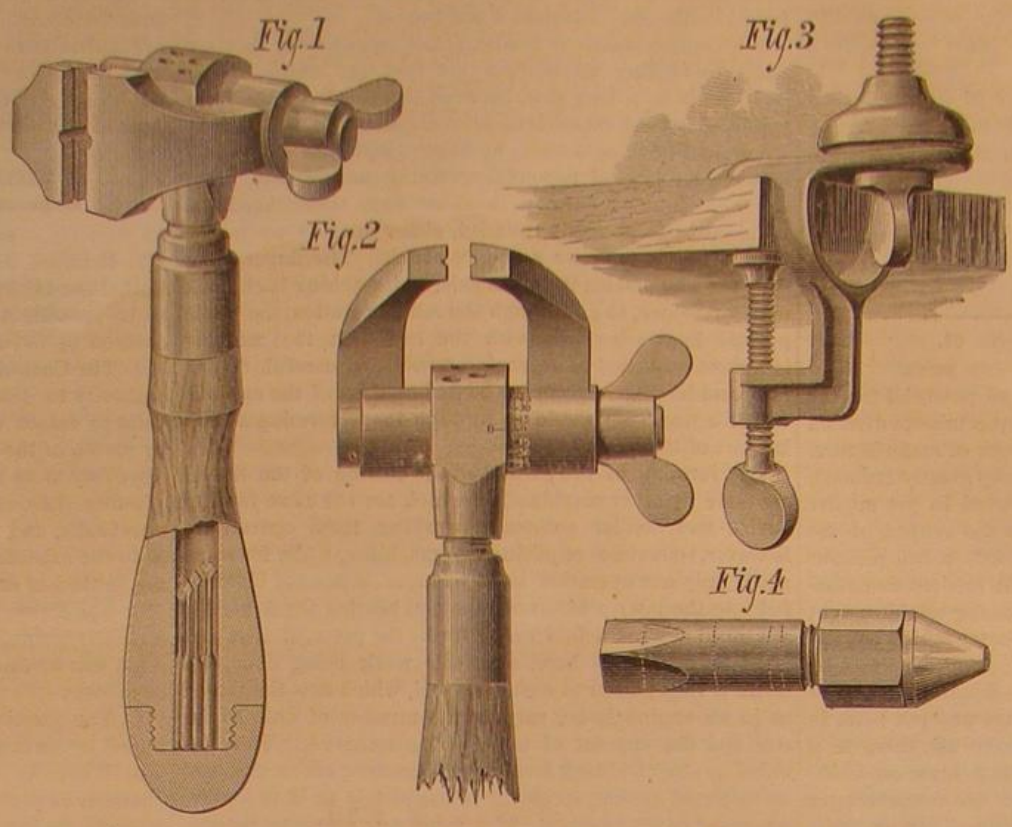
In either instance the vise can be made to hold any article that is to be filed, turned, bored, or otherwise worked, or the jaw may be used to hold any cutting or boring tool or bits, so that this tool is of general utility, especially upon all sorts of tool or hand work.

The cavities or countersinks in the clamping eye will receive the inner end of a boring bit or tool, the body being held by the jaws of the vise, and the tool, when used as a chuck in a lathe, can be arranged in line with the axis of motion or at an angle, as may be required, and will perforate, bore, or turn the interior or exterior of a cylinder or other article of greater or less diameter, according to the angle of the tool and its length. Graduations on the tubular stock and clamping eye indicate the angle of the one to the other. The jaws can be quickly and accurately adjusted to any degree of angle required, either above or below the center, right or left, and made ready for work by a quarter turn of the handle.

The solid forged ferrule of the handle of the vise is bored to receive the shank of a drill, and the addition of the drill chuck shown in Fig. 4 makes it a complete drill holder. The shank shown in connection with the drill chuck, in Fig. 4, adapts the device to a common bit brace or lathe, and the same shank may be applied to the vise for heavier work.

All of the parts of the vise are of steel, drop-forged, and milled. It is well made, substantial, and durable.

This useful tool is made and sold by Mr. B. F. Stephens, 95 and 97 Liberty street, New York city.



B. F. STEPHENS' SOLID STEEL HAND AND BENCH VISE.

IMPROVED AWNING AND VENTILATOR.

The novel window awning shown in the engraving is capable of being readily put into various positions to shade the window and to effect a proper circulation of air in the apartments.

Window awnings, as commonly made, are only capable of shading the window, and as they are closed at the top it makes an effective funnel for drawing into the room heated air from the building and pavements and foul air from the street and gutter, without affording any means of exit.

The frame, A, of the improved awning, shown in Fig. 1, consists of the upper and lower bent bars, *a b*, pivoted together at their ends, and secured to the window frame by means of thumb screws, *c*. The awning cover, B, is attached at its upper and lower ends to the bars, *a* and *b*, and at its lateral edges to the window frame by buttons or rings. This construction practically divides the awning into two sections, *d e*, either of which can be opened or closed, as may be required. The only difference between the old frame and the new one is, that the latter has two bars instead of one, and is attached to the middle of the window frame instead of the lower quarter. The new awning also has an extra cord and pulley, and requires a little more canvas than the old style, but this is more than compensated for by the readiness with which it may be applied to a window, no fitting, cutting, or nailing being required, and the inventor states that when the durability of this awning is considered it is much cheaper than the common form.

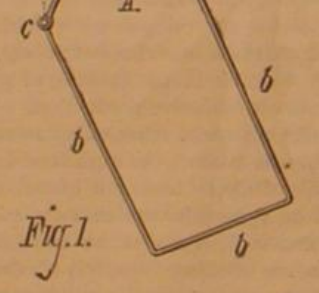
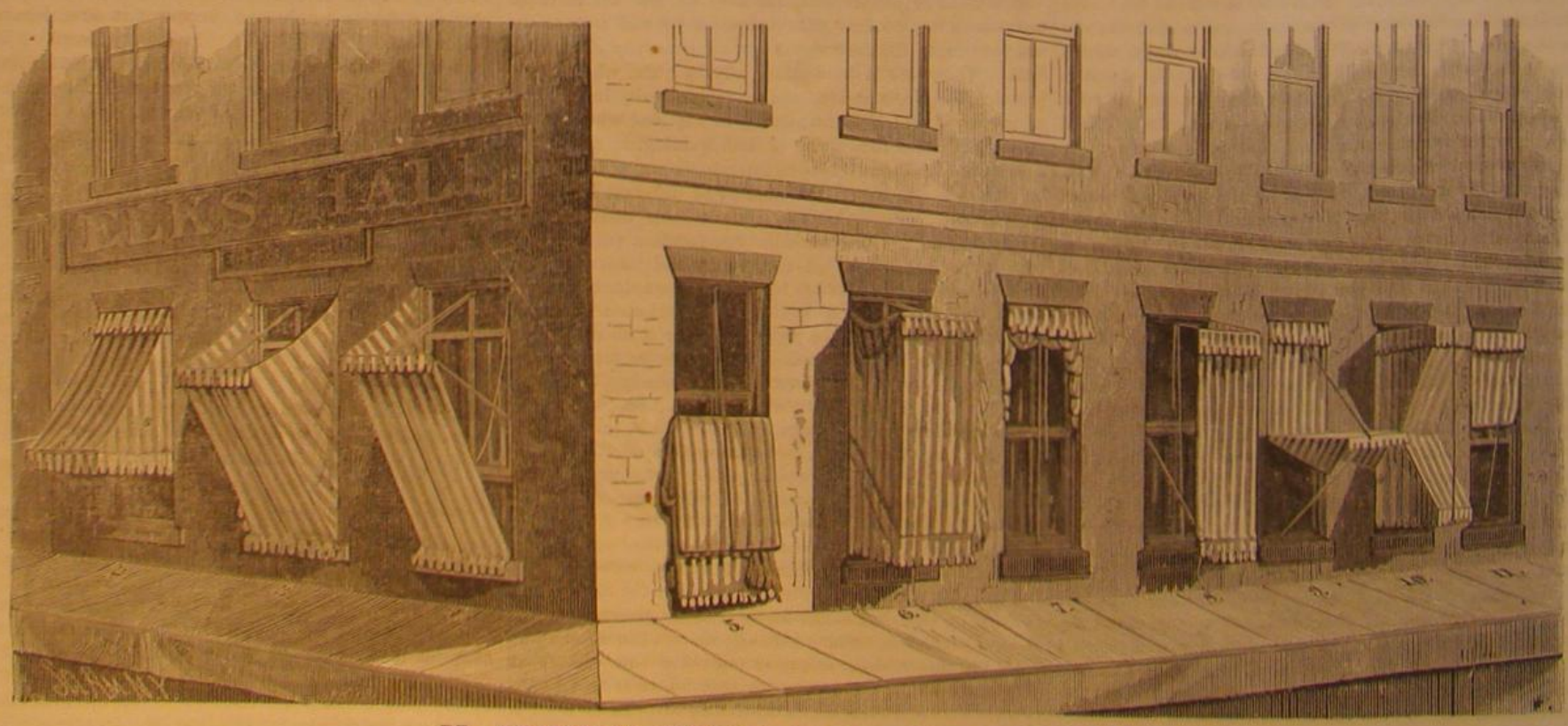


Fig. 1.

The various ways in which this awning may be arranged are shown in the annexed engraving, which is taken from a photograph, and accurately represents the invention as applied to the building at the corner of Gay and Baltimore streets, Baltimore, Md.

Fig. 2 shows the old style of awning with improvements attached. Fig. 3 shows an adjustment made by loosening a central cord, opening the top, and closing the bottom, placing the awning in an inverted position. Fig. 4 shows the awning having one of its sides dropped on its inner surface. With this arrangement, when the wind blows along the side of the building, it is gathered and directed into the room. Its action in this case is similar to that of a wind sail used on vessels at sea. Fig. 5 shows the upper half of the window exposed; the reverse of this is shown in Fig. 11. Fig. 6 shows an arrangement that is often desirable, especially after the awning has been rained upon, as it allows air to pass around its entire surface, drying it rapidly, and thus avoiding mildew and decay. The awning, when drawn up into small compass, is shown in Fig. 7. It may, in the same manner, be drawn down and secured at the bottom. These positions render the awning perfectly secure against any wind storm. In Fig. 8 both sides of the awning are dropped on its inner surface. This arrangement is desirable in many ways, especially when the awning is used on the south side of a business street, as it will effectually protect the eyes from light reflected from the buildings opposite. Fig. 9 shows a desirable arrangement when the sun is at or near the meridian. The central cord, in this case, is fastened on the outside of the awning. Besides the arrangements shown in the engraving, the awning may be placed in eight other positions.

In devising this awning the inventor takes advantage of the tendency of heated air to rise and of cooled air to descend. The awning, when inverted, permits the foul air to escape from the room, and allows the descending column of cooler air to enter the room, thus equalizing the temperature, so that there is but two or three degrees difference between the internal and external air. The inventor has proved the efficiency of the awning when thus arranged, not only in thoroughly ventilating and cooling the apartment, but also in excluding the noxious vapors that rise from the street and gutter at night. The great advantage possessed by this awning over others, in this respect, will be apparent without explanation. It is also effectual in excluding



DR. DWINELLE'S WINDOW AWNING AND ROOM VENTILATOR.

dust during wind storms while permitting of perfect ventilation.

The inventor says that by the aid of these room "ventilators" every bed-chamber can be made a sanitarium during summer epidemics.

The germs of diseases, animal and vegetable parasites, fungi, albuminoid ammonia, etc., which are swept from the streets and gutters by servants into the air and carried into our sleeping rooms for hours before our waking, will find an effectual check by the use of these inverted "awnings," rendering us many times less liable to sickness, for it is a well known fact among physicians that persons are more liable to take disease during their sleep.

These room ventilators are so constructed that their entire surface can be brought under the immediate inspection of the eye, and within reach of the brush and cleaner. By drawing up the lower part of it and letting the upper bar fall through the lower one, the canvas is turned inside out, bringing its upper outer surface close to the window, where it may be freed from dust, spots, or stains, and cleaned with suitable washes for preserving its colors and making it last three times as long as the old style awnings, which are nailed securely to the top and sides of window fames, putting all of the outer surface of canvas beyond the reach of any protection, and which, too, after it has been rained upon, though the sun may shine for days and dry its outer surface, the space between the awning and upper sash is filled with choke damp air, containing minute fungi, causing the cloth to mildew and decay in a short time, also emitting noxious odors into the room, which is familiar to every one who has had much experience with the common style window awnings. As these "ventilators" are reversible, they can be readily turned inside out, and they may be used in that condition after the outer surface has faded or worn seedy.

A number of letters recommending this invention very highly have been shown us by the inventor; among them we notice one from Dr. James A. Stewart, Health Commissioner of Baltimore, an authority in medical and sanitary science, and another from Mr. George A. Frederick, a well-known architect of Baltimore.

It is needless to refer to the further advantages of this useful invention, as they will be apparent to any one having had experience in the window awnings or ventilators of the ordinary kind. This is a simple device that combines both in a very effective manner.

These improvements were patented August 24, 1880, by Dr. James E. Dwinelle, southeast corner Broadway and Baltimore St., Baltimore, Md., who may be addressed for further information.

A Spinal Root of the Optic Nerve.

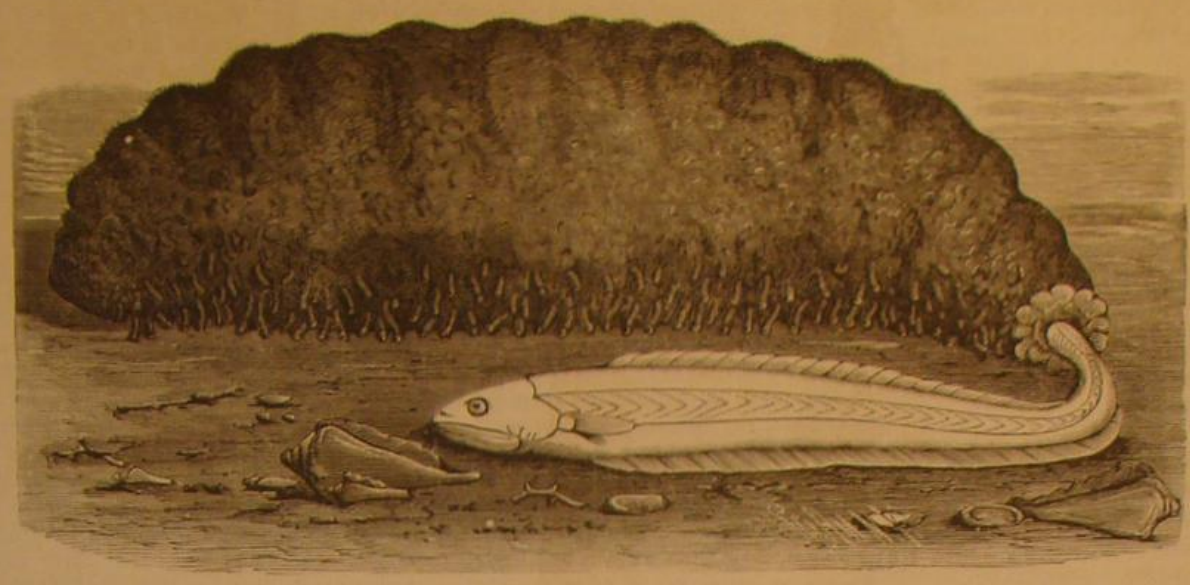
Stilling of Strasburg showed preparations to the International Ophthalmological Congress, at Mailand, in Septem ber last, which he believes demonstrate the existence of a spinal root of the optic nerve, which brings the retina into direct connection with the medulla. This root passes from the external corpus geniculatum, in a winding course, deep between the bundles of the crus cerebri, and can be traced into the pons; and it appears to course down in the direction of the medulla, although its further progress cannot be demonstrated.

The existence of this branch is interesting on account of the light it throws on certain physiological relations between the medulla and the retinæ, and may constitute the hitherto undiscovered link between certain diseases of the spinal cord and of the optic nerve.

A STRANGE PARASITIC FISH.

BY C. F. HOLDER.

Among the marine parasites we find several fishes whose peculiar methods in the struggle for existence are worthy of being recorded; one is the fierasfer, found by the writer in the Bêche de Mer, and the other the attendant of the physalia. Between Bird, Long, and Garden Keys, of the Tortugas group, a large shallow reef sweeps away to the south, fringed on the outside with breakers and a submerged wall of dead coral and other *débris* washed up from time to time.



PARASITE FISH.

The clear water within is rarely over four feet deep, some portions being pure white sandy bottom, while other parts are overgrown with large tracts of coral, astreas, meandrina, etc. Here is the collector's paradise. Among the huge heads of meandrina, numerous rare and beautiful fishes move lazily about. The branch coral swarms with radiates and crustaceans, while the sandy bottom and clear water are peopled severally with hordes of creatures adapted for their various surroundings. In drifting over these submarine gardens, new features appear at every step, and with a small coral hook and a pair of grains, enough specimens can be collected in a day to stock a large museum. The most common objects on the bottom are the large black echinus and the bêche de mer. The latter here attain their largest size, and their worm-like forms are seen stretched out in various positions. While drifting over this reef we came upon an extremely large specimen; jumping over, we lifted it from the bottom, and were about to throw it into the boat when our attention was attracted by the end of a fish protruding from the mouth of the holothurian. Holding it over a glass jar in the boat, we saw a long, silvery, eel-like fish gradually squirm out of his mouth. It dropped into the water, and after several attempts to swim, sank to the bottom, and shortly died. It was about eight inches long, tapering down to the tail, and in color clearly resembling the fishes from the Mammoth Cave. A delicate dorsal fin extended the entire length of its back, and its whole appearance was eel-like. Suspecting that the fish was a phenomenal parasitic occurrence, we collected other holothurians, and in many of them, after cutting open the thick skin, found the same fish, and in every case it died when exposed to the open water, showing conclusively that it could not live out of the stomach of its protector. Careful examination of the reef, covering a period of eight or nine years, failed to show one of these fishes in any other condition than the above, and its habits, methods of increase, all are as much an enigma as have been some of the habits of our common eel. The fish, doubtless, takes its position in the holothurian when young, and either feeds upon the entrails of the animal or upon the food it takes in; either conditions are possible, as the holothurian, if deprived of a part of its internal machinery, every day could easily reproduce it, and would probably offer no objection, as we have frequently seen them disgorge their entire internal system, and reproduce a new set.

The holothurian in which this fish is found has for its specific name *Floridana*, and is a large dark-brown sea cucumber, with the feet scattered irregularly over the body, and with smaller tentacles than in *Pentacta* of our northern coast. The alimentary canal is often found filled with pieces of shell, corals, etc. It is about three times as long as the body, with longitudinal small folds, and held in place by a large, broad mesentery, which accompanies the intestine throughout the greater part of its length, terminating suddenly in a cæcum much larger than that of the above-mentioned species. In this canal lies snugly ensconced the fierasfer, now feeding on the pieces of coral or mollusca taken in by its host, or in default of this, tearing and lacerating the sides of its self-constituted prison. Its entrance into the alimentary canal of the cucumber may be attended with some danger, as the pharynx of the *Floridana* is calcareous, while in *Pentacta* it is muscular. Another species is found inhabiting the star fish (*Culcita.*)

Concerning the methods of reproduction of these animals nothing is known, and the fact that those observed by the writer died upon escaping from the holothurian makes the question still more enigmatical. They undoubtedly seek the protection of the holothurian instinctively when young, and a curious example of quasi-reasoning power in low organisms is evidently shown. The Rev. J. H. Murphy, in his work entitled "Habit and Intelligence," seems to regard instinct as the sum of inherited habits, remarking that "reason differs from instinct only in being conscious. Instinct is unconscious reason, and reason is conscious instinct."

SWORDBILL HUMMING BIRD—(*Docimaster ensiferus.*)

THE SWORD BILL HUMMING BIRD.*

This humming bird derives its name from the singular shape and size of its beak, which is very nearly as long as the rest of the body.

This curious species is rather large, as it measures about eight inches in length. It inhabits Santa Fé de Bogóta, the Caraccas, and Quito, and is generally found at considerable elevations, having been often seen at a height of twelve thousand feet above the level of the sea. The inordinately long bill is given to this bird in order to enable it to obtain its food from the very long pendent corollas of the brugmansiæ, and, while probing the flowers with its beak, it suspends itself in the

* Wood's Natural History.

air with a tremulous movement of the wings. Its movements are singularly elegant, and while engaged in feeding it performs the most graceful maneuvers as it probes the pendent blossoms, searching to their inmost depths. The nest of this species is hung to the end of a twig, to which it is woven with marvelous skill, and its whole construction is very beautiful.

The adult male bird is colored as follows: The head and the upper part of the body are green, glossed with gold in some parts and with bronze in others, the tints changing according to the light. The wings are dark black-brown with a purple gloss, and the tail is dark black, bronzed on the upper surface. Behind each eye is a small but conspicuous white spot slightly elongated, and there is a broad crescent-shaped mark of light green on each side of the neck. The under parts are of a bronze green, and the under tail coverts are flecked with a little white. The female is of much the same color as the male upon the upper parts of the body, except that there is a little white upon the lower part of the back and a narrow white line behind the eye. The throat is brown, each feather being slightly edged with gray, and there is a very faint indication of emerald green on part of the throat. The young male is much like the female, but is more coppery in his hues. The throat is white, speckled with brown, because each feather is white with a brown tip. At each side of the throat there is a large patch of green intermingled with white.

Correspondence.

Colored Lights in Parlor Theatricals.

To the Editor of the Scientific American:

Having occasion to assist in getting up a series of tableaux, considerable difficulty was encountered in securing a satisfactory light. Living at some distance from New York, a calcium light was difficult to procure, and, moreover, too expensive. The use of gas and reflectors had been suggested. Procuring two 14 inch glass reflectors, I experimented with gas, with poor success. While the amount of light reflected was unsatisfactory, the interposition of a sheet of colored glass, or even a film of gelatine, sensibly diminished its volume.

Compelled to fall back on colored fires, I constructed a furnace of tin at small expense, that succeeded beyond expectation. A tin cylinder, 18 inches in diameter, was opened out at the side to admit a pane of glass, 16 x 24 inches. This glass, fastened securely in its place, constituted one side of the box, the curved inner surface of bright tin served as a reflector. A sheet iron bottom and an 8 inch heater pipe, leading from the top of the cylinder out through a convenient window into the open air, completed the apparatus. At the back of the box was constructed a sliding door large enough to freely admit the hand and closing tightly.

The peculiarity of the apparatus was:

1st. The large smoke pipe which was necessary to conduct rapidly away the large volume of smoke generated; and,

2d. The box was made as nearly as possible *air tight*. The chlorate of potash furnished all the oxygen necessary for combustion, and all the air necessary for draught was admitted through the slide door, which could be closed quickly upon any indication of a back draught.

The following formula for red fire gave the best results:

Powdered nitrate of strontia	8 ounces.
Powdered chlorate of potash	4 "
Shellac in coarse powder	2 "
Lycopodium	½ ounce.

This mixture burns slowly, gives a good light, contains no sulphur, and can be prepared by any druggist.

By placing the fire in tin troughs, 8 x 10 inches long, the amount of light and length of burning can be regulated to a nicety, and by alternating red, blue, and green in the same trough, these colors can be exhibited in any desired succession.

In a furnace of this description I burned colored fires for an hour without the slightest disagreeable odor being perceptible in the room. Hoping my experience might prove of value to some of your many readers, I remain,

Yours truly,

W. K. ROY.

Wappinger's Falls, N. Y., December 11, 1880.

Indian Ethnology.

Major J. W. Powell, Chief of the Bureau of Ethnology, Washington, lately gave to the *Republican*, of Omaha, Neb., information to the effect that there are now eight official parties in the field engaged in making a study of the North American Indians—their condition, their habit of life, their languages, their history, etc., as well as taking a census of them. These parties, who are roughing it with tents, mule teams, etc., are scattered throughout California, Nevada, Utah, New Mexico, and Arizona, and Major Powell was then on his way to visit them all to ascertain personally how they are progressing with their work. The taking of the Indian census was begun October 1, and will probably not be finished until next spring, owing to the scattered locations of the various tribes. The name of every Indian is written out in full, together with age, sex, etc., and other statistics are obtained, just the same as of the civilized citizens of the United States, so far as practicable. Besides these eight ethnological parties who are doing this work, there are special agents of the Census Bureau who are assisting with the various Indian agents. It is estimated that the total number of Indians in the United States will foot up over 300,000. One of Major Powell's parties has just discovered in New Mexico and Arizona a number of old ruins and pueblos, which means old Indian villages. These are now being carefully explored. In New Mexico they have discovered, west of Santa Fé, the largest collection of ruins ever found on this continent.

Sea Elephants at Heard Island.

Heard Island is a barren formation 25 miles long, 6 miles broad, area 80 square miles, a considerable portion covered with glaciers. It is situated in about lat. 53° 10′ S. and long. 73° 30′ E., being about 2,500 miles southeast of the Cape of Good Hope, and 300 miles south of Kerguelen's Land. Heard Island is of volcanic origin. In the central part of the island a mountain, known as Big Ben, rises to a height of 7,000 feet. The island was visited by the steamer Challenger in 1874, and Mr. H. N. Moseley, in his "Notes by a Naturalist on the Challenger," gives the following particulars relating to sea elephants, which are found there in great abundance:

The sealers said that the climate of Heard Island was far more rigorous than that of Kerguelen's Land.

In winter the whole of the ground is frozen and the streams are stopped, so that snow has to be melted in order to obtain water.

In December, at midsummer, there is plenty of sunshiny weather, and Big Ben is often to be seen.

It is possible to land in whaleboats, on the average of the whole year, only once in three days, so surf-beaten is the shore, so stormy the weather.

We saw six sealers. Two were Americans, and two were Portuguese, from the Cape Verde Islands.

They were left on the island by the whaling vessels which we met with at Kerguelen's Land, their duty being to hunt sea elephants.

The men engage to remain three years on the island, and see the whale ships only for a short time in the spring of each year. On the more exposed side of the island there is an extensive beach, called Long Beach.

This is covered over with thousands of sea elephants in the breeding season, but it is only accessible by land, and then only by crossing two glaciers, or "icebergs," as the sealers call them.

No boat can live to land on this shore, consequently men are stationed on the beach, and live there in huts, and their duty is constantly to drive the elephants from this beach into the sea, which they do with whips made of the hide of the elephants themselves.

The beasts thus ousted swim off, and often "haul up," as the term is, upon the accessible beaches elsewhere, and there they are killed, and their blubber is taken to be boiled down.

In very stormy weather, when they are driven into the sea, they are forced to betake themselves to the sheltered side of the island, hence the men find that stormy weather pays them best.

Two or three old males, termed "beach masters," hold a beach to themselves, and cover it with cows, but allow no other males to haul up.

The males fight furiously; and one man told me that he had seen an old male take up a younger one in his teeth and throw him over, lifting him in the air.

The males show fight when whipped, and are with great difficulty driven into the sea. They are sometimes treated with horrible brutality.

The females give birth to their young soon after their arrival. The new-born young are almost black, unlike the adults, which are of a light slate brown, and the young of the Northern bladdernose, which are white.

They are suckled by the female for some time, and then left to themselves lying on the beach, where they seem to grow fat without further feeding. They are always allowed by the sealers thus to lie, in order to make more oil.

This account was corroborated by all the sealers I met with. I do not understand it. Probably the cows visit their young from time to time unobserved. I believe similar stories are told of the fattening on nothing of the young of Northern seals.

Peron says that both parent elephant seals stay with the young without feeding at all, until the young are six or seven weeks old, and that then the old ones conduct the young to the water and keep them carefully in their company. The rapid increase in weight is in accordance with Peron's account.

Charles Goodrich gives a somewhat different account, namely, that after the females leave the young, the old males and young proceed inland, as far as two miles sometimes, and stop without food for more than a month, and during this time lose fat.

The male elephants come on shore on the Croyets for the breeding season at about the middle of August, the females a little later.

There was said to be forty men in all upon Heard Island. Men occasionally get lost upon the glaciers.

Sometimes a man gets desperate from being in so miserable a place; and one of the crew of a whaler that we met at Kerguelen's Land said, after he had had some rum, that occasionally men had to be shot; a statement which may be true or false, but which expresses, at all events, the feelings of the men on the matter.

The men that we saw seemed contented with their lot. The "boss" said, in answer to our inquiries, that he had only one fur seal skin, which he would sell if he was paid for it; but he guessed he'd sell it anyhow when he got back to the States.

He had been engaged in sealing about the island since 1854, having landed with the first sealing party which visited the island.

For his present engagement his time was up next year, but he guessed he'd stay two years more.

He'd make five hundred dollars or so before he went home, but would probably spend half of that when he touched at the Cape of Good Hope on the way. The men had good clothing, and did not look particularly dirty.

They lived in wooden huts, or rather under roofs built over holes in the ground, thus reverting to the condition of the ancient British.

Around their huts were oil casks and tanks, and a hand barrow for wheeling blubber about. There were also casks marked molasses, flour, and coal.

The men said they had as much biscuit as they wanted, and also beans and pork, and a little molasses and flour. Their principal food was penguins (*Eudyptes chrysolphus*), and they used penguin skins with the fat for fuel.

Captain Sir G. S. Nares saw five such skins piled on the fire one after the other in one of the huts.

MISCELLANEOUS INVENTIONS.

A tool for holding small articles or pieces of jewelry while being soldered, so as to dispense with binding wire, plaster of Paris, and the various inconvenient, troublesome, and dirty contrivances hithertofore used in such work, has been patented by Mr. Louis G. Grady, of Halifax, N. C. This invention consists in a bar or plate provided with articulated arms that carry tweezers, the parts being so constructed and arranged that the articles or parts can be placed in the tweezers and brought together and held in any required position for being soldered.

An improved time signal for railways has been patented by Mr. Horace A. Wayne, of Manlius Station, N. Y. The invention consists in the combination of a clock with hands and dial as usual, and a clock movement without an escapement, that moves the hands of the indicating dial, and having a stop lever that is released by the passing train, the two clocks being so connected that the indicator remains immovable until a train passes, when it is released and moves until its hands catch up with or indicate the clock time, and it is again stopped.

Mr. Oliver Bryan, of New York city, has patented a hot air furnace, so constructed that the air when heated will be pure, the heating surfaces can be readily inspected and cleaned, and the fire will act instantly and uniformly upon all the heating surfaces, making the expansion equal and the radiation of heat quick and regular.

Mr. Abraham Mayer, of New York city, has patented an improved optometer or instrument for ascertaining the number and kind of glasses required by persons having an impaired sight, making the use of spectacles necessary. The invention consists in a case containing one or more sets of lenses arranged on an endless band in such a manner that a standard card, which is held on the end of an adjustable pivoted arm, can be read through the several lenses successively, so that the lenses suiting the eyes of the experimenter can be determined very easily and rapidly.

An improved furnace for burning chaff, etc., has been patented by Mr. Alonzo Moore, of Bangkok, Siam. In ordinary furnaces fuel is usually supplied at intervals, which chokes to a considerable extent the evolution of gases from the combustion. In so supplying the fuel the boilers are exposed to sudden changes of temperature, causing injurious expansions and contractions. To overcome these objections is the object of this invention.

Mr. H. L. Warren, of Alma, Ohio, has patented a fan blower for thrashers, by the use of which the feeders and band cutters will be protected from the cloud of dust that constantly issues from the mouth of the machines.

Mr. James R. Barry, of Yonkers, N. Y., has patented a combination puzzle and game apparatus, which consists of a short rod, a stationary handle, and four or more balls or short cylinders having alternate numbers and letters formed upon them in such an order that when the balls are arranged in a particular position the sum of the various columns of numbers will be the same, and the various columns of letters will spell words.

A harness buckle, the tongue of which may be locked upon the buckle frame, and of such construction that the pull of the engaged trace or strap shall be straight, and not at an angle thereto, has been patented by Messrs. Casper L. Marschall and Anthony Marschall, of Evansville, Ind.

A calendar, to be attached to a clock and operated in connection therewith, and exhibits but one number or date at a time, and that number or date in large or plain figures, has been patented by Mr. Peter Wagner, of New York city.

An improvement in the tunnels of base burning stoves, whereby the coals can be retained in the tunnel in case a weak fire is desired or in case the fire has gone out and the ashes and cinders are to be removed, so that the coal in the tunnel can be dropped on to a fresh fire, has been patented by Mr. Edward C. Smith, of Lincoln, Neb.

Mr. Charles L. Shaw, of Nora, Ill., has patented an improvement in flood gates for streams, hollows, and lowlands liable to be overflowed by a sudden rise of water. They are so constructed that they will not wash away, and will allow the water, and any rubbish being carried down by the water, to pass freely.

Mr. Marshall Pratt, 55 Beekman street, New York city, is introducing a novel, efficient, and cheap razor strop, consisting of a finely grooved wooden strop saturated with a fixed oil and coated on both sides with an improved paste.

Mr. Timothy B. Rider, of Fitch Bay, Quebec, Canada, has patented an improvement in the class of automatic safety attachments for steam boilers whose function is to dampen or extinguish the fire by allowing escape of water from the boiler into the fire box in case the water becomes too low or the steam pressure too high for safety. The inventor employs a tank containing a float and lever which operate a valve that controls escape of water to the fire box, as heretofore, but he has so constructed and arranged these parts as to make the apparatus more compact, less liable to get out of order or become inoperative, and more efficient generally.

An improved disk mill for crushing and grinding different materials has been patented by Mr. Carl Fink, of Berlin, Germany. This apparatus, it is said, operates much more rapidly and easily than vertical millstones or ordinary crushing mills, and the disks can be cooled in a more efficient manner than the stones or rollers of ordinary mills.

Mr. W. Clay Lutz, of Bedford, Pa., has patented an improvement in that class of railroad cross ties in which the material used is metal.

Messrs. Hermann Koeller, of New York city, and Charles Nimmo, of Greenpoint, N. Y., have patented an improved drip oil cup. The object of this invention is to provide an improved oil drip cup for the crank connections of steam engines and other mechanism, which can be adjusted to fit any connection, and not only catches the oil that drops from the journal, but also the oil or grease that is thrown from the crank connection by centrifugal force.

An improvement in the class of dogging apparatus which is affixed to one of the knees of a head block of the log carriage, has been patented by Mr. William J. Wickham, of Forest Home, Texas.

Mr. Frederick Koskul, of Grand Rapids, Mich., has patented a process of treating metallic foil to form veneers, which consists in, first, painting or lacquering it; secondly, varnishing it; thirdly, baking it; and fourthly, subjecting it to pressure.

An improvement in steam boilers and furnaces has been patented by Mr. Joseph E. Culver, of Jersey City, N. J. The improvement relates to steam generators wherein the heated products of combustion may be commingled with the steam for use with an engine, or for heating purposes, or used separately.

Mr. Jacob R. Scott, of Nyack, N. Y., has patented improvements which relate to machines for sewing boots and shoes of the class wherein a rocking looper is fitted in the horn. The object of the invention is to provide means whereby the looper will always be held in the proper position relative to the needle while the horn turns.

New Plan for the Drainage of Chicago.

A committee appointed by the Citizens' Association, of Chicago, to devise a system of improved drainage adapted to the present and future needs of the city have reported in favor of a vast sewer to drain the entire district traversed by the Chicago River. The estimated cost of the work is $6,850,000, but it is thought that to complete it in every respect the sum of $12,000,000 will probably be necessary. The line of the proposed sewer, as shown in the map made by the engineer of the committee, Mr. A. J. Mathewson, is as follows: Commencing at the mouth of the Regula or Mud Lake fork of the south branch of the Chicago River it runs west through the lake toward the Desplaines River north of Summit; then curving to the left it passes in a southwest direction between the canal and the river to Mount Forest, Willow Springs, Sag Bridge Station, and Lemont to the Romeo bend of the canal, Norton's tail race at Lockport, and to a point opposite lock No. 1 at Lockport; thence to a point at the head of the pond of dam No. 1, Joliet, a few hundred feet northwest of Lock No. 4 of the Illinois and Michigan Canal, a distance not far from 31½ miles.

For the southwestern terminus the sewer runs about 2½ miles N.N.E. to a point opposite Lock No. 1, with a fall to the south of about 12 feet in bottom of sewer, or 4$\frac{8}{10}$ feet fall per mile, and the average width of 15 feet; thence north and northeast, past Romeo and Lemont, Sag Bridge Station, Willow Springs, Mount Forest, Summit, and Mud Lake, or regular route, touch Bridgeport, a distance from Lock No. 1 of 20 miles, and an ascent of 1 foot per mile, making 29 feet fall from Bridgeport to Lockport in bottom of sewer, with a width of sewer at lower end of 20 feet, and at upper end of 49 feet for compensation.

Good, substantial abutments and bridges at all crossings will be necessary throughout, and at Big Run, Norton's tail race, and Fraction Run an arch about 300 feet long, in each, will be needed to let the water from these several places pass over the top of the sewer. The eastern portion of this route is already excavated to about the proper width, but not to the proper depth. The sewer when completed should draw water from the surface to the bottom of the river, low water, datum line for the first 29 miles. A portion of West Chicago and the town of Cicero, under an arrangement with the city, may drain directly into the main sewer. The amount of excavation for the above sewer, by a careful approximate estimate will be 3,031,285 cubic yards; cost of excavation—earth and rock, slope wall, inverted arch in bottom, and the three arches aforesaid, $6,365,698; contingencies, engineering, etc, $483,625; total cost, $6,849,323.

New Memphis.

The Memphis *Avalanche* declares that all sanitarians who have examined the successful working of the new sewer system of that city, and who are familiar with the sanitary condition of other American cities, agree that Memphis is the best sewered and best drained city on the continent. The absence of sewer gas, the abolition of all privy vaults, and the thorough underdrainage of the soil, are marked features of the Memphis sewer system that are lacking in other cities The effect of this thorough sanitary revolution, the *Avalanche* continues, cannot but have a marked influence in decreasing the mortality rate, and it may confidently be anticipated that Memphis will hereafter be entitled to be styled not only the cleanest but the most healthy city on the continent.

How many other American towns and cities are waiting, as Memphis did, to be depopulated and threatened with general bankruptcy in business as well as in health, by repeated epidemics, before adopting an adequate system of general sanitation?

The Atlanta Cotton Fair.

A grand international exhibition of the appliances and machinery used in raising, preparing, and manufacturing cotton, with samples of cotton fiber and fabrics, and all other matters bearing upon the cotton interests, is announced to be held in Atlanta, Georgia, during October and November next. At a large and enthusiastic meeting of business men in Atlanta, December 2, the International Cotton Exhibition Association was organized with the following named officers: President, Senator Joseph E. Brown, of Georgia, and twenty-five vice-presidents from the principal cities and manufacturing towns of the country; Treasurer, Samuel M. Inman, of Atlanta; Secretary, John W. Ryckman, of Philadelphia; Executive Committee, the Mayor of Atlanta, *ex-officio*, Chairman, H. J. Kimball, R. F. Maddox, W. I. Calhoun, B. E. Crane, W. H. Patterson, M. C. Kiser, Evan H. Howell, and W. B. Cox, of Atlanta; Edward Atkinson, of Boston; Richard Garsed, of Philadelphia; Cyrus Buzby, of New Orleans; J. W. Paramore, of St. Louis; John H. Inman, of New York. The Finance Committee are: Robert J. Lowry, Paul Romare, and D. N. Spear, of Atlanta; Morris Ranger, of New Orleans; Thomas Dolan, of Philadelphia; William A. Burke, of Lowell, Mass.; William Gray, Jr., of Boston, Mass.; and J. H. McMillen, of Biddeford, Me.

The Adirondack Survey, New York.

The year's field work of the Adirondack Survey, under Mr. Verplanck Colvin, was ended December 1, when the superintendent and his assistants returned to Albany. The last triangulation station was on Bluebeard Mountain, near Lake Pharaoh. The mountains had been covered with snow for two months; very heavy snowfalls occurred about the middle of October.

The measurements of the season extend the work to the southeastern borders of the Adirondacks, and cover the location of a great number of trigonometrical stations in the counties of Essex, Hamilton, Warren, and Saratoga, and the northeast corner of Washington County. The heights of a great number of mountains, until now unmeasured, with altitudes of lakes and other new prominent points in those counties, have been determined, measurements of vast numbers of air-line distances for the purpose of locating signals, mountain lakes, and land lines have been made, together with special surveys of lakes and rivers. A full account of these new measurements will be given in Superintendent Colvin's next report to the Legislature.

Wickersheimer's Preserving Fluid.

According to the Boston *Journal of Chemistry*, the following is said to be the formulæ now adopted by prominent manufacturers in Berlin for this liquid, according as it is to be used for injecting or immersing bodies:

	For injecting.	For immersing.
Arsenious acid	16 grammes.	12 grammes.
Sodium chloride	80 "	60 "
Potassium sulphate	200 "	150 "
Potassium nitrate	25 "	18 "
Potassium carbonate	10 "	15 "
Water	20 liters.	10 liters.
Glycerine	4 "	4 "
Wood naphtha	¾ liter	¾ liter.

Hager suggests the following as a substitute for Wickersheimer's preparation:

Salicylic acid	4 drachms.
Boracic acid	5 "
Potassium carbonate	1 drachm.
Dissolved in hot water	12½ ounces.
Glycerine	5 "

Then add—

Oil cinnamon, oil cloves, each 3 drachms, dissolved in alcohol	12½ ounces.

The latter fluid is not poisonous, and possesses the desirable property of acting as an antiseptic, and also as a preventive and exterminator of moths and vermin, and is possessed of a pleasant odor. The borosalicylate may be used in connection with other solvents if desired.

Progress in Silk Manufacture in America.

During a recent visit to the silk mills of Paterson, N. J., Mr. Brocklehurst, of Macclesfield, England, a member of one of the largest silk manufacturing firms in the world, was much impressed by the rapid progress which the silk industry is making in this country. He was especially surprised by the general use of steam power looms in weaving the more delicate and costly fabrics, an improvement only now being tried experimentally in England, and by the wide scope and variety of the work done in each and all the mills.

A Big Melon Patch.

Missouri boasts of possessing one of the largest and most productive melon patches in the United States. It is situated on the borders of Scott and Mississippi counties, and equals if it does not exceed in size and adaptation of soil and climate the famous melon patches of Georgia, Indiana, and the eastern shore of Maryland. The St. Louis *Republican* describes it as a tract of sandy prairie, four miles wide and ten miles long, with a thin, warm soil, just adapted to the cultivation of the melon, and such melons as are raised nowhere else in that region. There is much richer and deeper soil all around there, but it is not adapted to melon culture. This land is capable of producing 1,000 melons to the acre. At a place called Diehlstadt, in Scott County, there were shipped the past season 439 car loads of 1,000 to the car, and Bertrand, in Mississippi County, shipped 180 car loads, mostly to Chicago. The melon county was visited by 25 commission merchants from Chicago, who paid as low as $40 and as high as $140 per car load, being an average of $70 per car, the market price varying with the advance of the season and the number of melons ripening at the same time. Most of these melons were shipped over the Cairo and Vincennes and Illinois Central Railroads in fruit cars, properly ventilated and arranged for the purpose. These melons found their way not only to St. Louis and Chicago, but to most of the lake cities, and even to New York and Philadelphia.

Melons are getting to be such a staple of production that the cultivators are asking for increased railroad facilities to move the product at the proper season, and recently the Hon. Henry J. Deal, the newly-elected member of the Legislature from Charleston, Mississippi County, applied to Superintendent Soper, of the Iron Mountain Railroad, with a petition numerously signed, representing that they will plant 700 acres more next year in melons if the railroad will give them a side track and station at a point on the Iron Mountain Railroad three miles north of Charleston, to be called Melon Station. Mr. Soper gave assurance that he would comply with the request of the petition. Col. Deal estimates that 700 acres ought to produce 700 car loads, at the rate of 1,000 melons to the acre, making 700,000 melons. One man can attend to twenty-five acres of melons. The variety of seed used is that of the Georgia melon, which is very luscious and grows to a great size, some weighing as high as 60 pounds. The hills are planted 14 feet each way apart and from three to four seed are put in a hill. They commence shipping melons about the 20th of July, and continue to the last of August.

Spontaneous Combustion of Soft Coal.

The Boston Manufacturers' Fire Insurance Company states that at present rates of prices semi-bituminous and soft coals are coming into more general use than they have been, especially culm or fine coal.

Members are warned that, with few exceptions, such coals are very liable to spontaneous combustion, if stored when the least wet or damp in closed sheds where there is little or no circulation of air. If such coal is not protected from being wet, it is said to deteriorate.

The company objects to the storage of semi-bituminous or bituminous coal in or under any building covered by its policies, or in or under any building that would expose a risk taken by this company to danger if it took fire.

It is suggested that a roof may be sufficient to protect soft coal from being much wet, and that, under a roof not confined at the sides, there would probably be such a free circulation of air as to prevent spontaneous combustion.

Photography in Engineering Works.

Photography has been employed by our large engineering and manufacturing firms for a long time. An English photographic journal speaks of some of their engineering establishments having photographic studios attached to their works, as if it was a new thing. Referring to those having such a department, the editor says Sir William Armstrong, at Elswick, and Sir Joseph Whitworth, at Manchester, may be cited among others; while the eminent firm of gun makers, Krupp & Co., in Westphalia, employ not only a photographic staff, but practice collotype printing and other elaborations of the photographic art.

Mercantile Shrewdness.

The London *Hatters' Gazette*, referring to the fact that China grass hats, which an American manufacturer had tried to introduce last season, but which proved an utter failure, adds that they have turned their large stock to a fresh use, and are advertising them as wall pockets. The brims are lined with satin of a bright color and gayly trimmed, and the crown is made to hold a whisk broom and other odds and ends. Trust a Yankee, naively adds the *Gazette*, for sitting down with a dead stock of a novelty which has failed to take!

Shipment of Bees to New Zealand.

Recently four colonies of bees were shipped from California for New Zealand. Each of the boxes in which they were to make their long journey was provided with an attachment at one side carrying a sponge, by means of which the bees were to be supplied with fresh water daily and the atmosphere of the hive kept sufficiently humid. Ventilation was provided for by openings covered with wire cloth and fitted with sliding doors; and a wire covered cage was attached to each hive for a cooling place for the bees in case the interior of the hive becomes too warm.

A Locomotive to Run Eighty Miles an Hour.

The Baldwin Locomotive Works have just entered into a contract with Col. G. A. L. Roberts, of Titusville, for the construction of a passenger engine which will be able to run eighty miles an hour, and maintain this rate of speed for 100 miles without stopping. The locomotive is to weigh 38 tons, and will comply with standard gauge. The driving wheels will be six feet in diameter. The forward trucks and those on the tender will be made of paper, which, it is said, will endure more strain and wear than iron or steel. The wheels will all be of the pattern known as the broad-tread, which will enable the engine to run on roads of either 4 feet 8½ inches or 4 feet 10 inches gauge. The most important feature of the locomotive will be the introduction of the Roberts patent cylinder and piston, which has proved capable of saving at least 20 per cent in steam pressure. The exhaust ports are in a continuous circle around the cylinder, in addition to the usual ports at the ends, and the steam escapes without the waste of force necessary to expel it, as in the cylinders of the old style. The tender will be so constructed as to carry a foot of water under the coal, as well as the usual amount on the sides. There will be a water chamber on the locomotive so arranged that compressed air from the air pump can be admitted in the top of the chamber upon the water, by which means a stream may be forced upon any hot bearing connected with the engine or tender. This is expected to overcome the trouble of hot boxes. The nozzles through which the steam is to pass and create a draught will be eight inches in diameter—about three times the usual size—and the boiler will be the largest that can be put upon the standard gauge tracks. It will be the strongest locomotive ever built, and perfect in every detail. Col. Roberts, the inventor, built a similar locomotive a few years ago, which drew the fast mail train over a portion of the Lake Shore Railway, but it was not a success, owing to its poor construction. The improvements it suggested will be taken advantage of in building the new engine. It is stated that Col. Roberts, who has visited Europe several times, and studied the railway systems of that country, is building his new engine for use upon the European Continent.

Tennessee Marble.

Mr. John J. Craig, of Knoxville, Tennessee, says that the United States Government has recently opened and is now working successfully a quarry of white stone in the immediate vicinity of that city which is pronounced by competent judges to be superior to anything of the kind found elsewhere in the United States for building and all out-door purposes. It is a highly crystallized limestone marble—and as it comes from the hammer or chisel is almost perfectly white; when polished it shows a faint pinkish blush, most delicate and beautiful; long exposure to the atmosphere seems to whiten and harden it, a sort of glass-like enamel forming over its surface and rendering it almost entirely impervious to dampness and stains of any kind. A column of this marble, which has been standing in Knoxville more than thirty years, and which has never been touched with brush or soap, is as white and clean to-day as it was the day it was first exposed to the storms and sunshine of our fickle climate. The texture and working quality of the marble is unsurpassed. It is neither too hard nor too soft, but exactly soft enough to allow the sculptor to work it without force and trace on it the finest lines of finished form, and yet hard enough to retain these lines in all their original delicacy, unimpaired by wind and rain, for generations to come. The quantity of the marble is unlimited. Knoxville is surrounded by whole mountains of it. Facilities for transportation are now good and daily growing better. Car loads are being daily shipped to all sections of the country, and the absence of capital alone prevents the quarrying of it from soon developing into one of the most important industries in that singularly favored but as yet almost unknown section.

The Paterson, N. J., Artesian Well Strikes Salt Water.

In the SCIENTIFIC AMERICAN of January 31, 1880, an account was given of the progress of the artesian well of the Passaic Rolling Mill until quicksand was struck at the remarkable depth of 1,100 feet. The well was piped through the quicksand and the boring continued. At a depth of 2,000 feet water was struck, the well having previously been so dry below the quicksand that water had to be poured in to lubricate the drill. The boring was continued to a depth of 2,053 feet, the water increasing in volume until it rose to within 32 feet of the surface. But this water was salt. Samples were sent to Prof. Cook, the State Geologist, who caused an analysis to be made. This showed that the water contained 974 grains of various salts to the gallon, about half of which was common salt. There was also a considerable percentage of chloride of calcium and magnesium, about 7 per cent of chloride of potassium, and considerable sulphate of lime, with mere traces of iodine and bromine.

Prof. Cook says he does not know what this water can indicate, unless it be that the well has got down pretty near to rock salt. From recent indications it appears probable that if the well were continued still further the water would flow out of the top, but as the company has no use for salt water in rolling and working iron it has been decided to abandon the project of securing a flowing well. The hole will be plugged below the quicksand, or about 1,120 feet below the surface, and the water will be pumped, an abundant supply of fresh, cool, and pure water being assured at that point.

The Yuba River Brush Dam.

The Marysville (Cal.) *Appeal* describes as follows the construction of the dam across the Yuba River, nine miles above Marysville, to restrain the mining *débris* and to improve the river channel. An excavation was made about one foot in depth and sixty feet wide, the ground at that depth being frequently very solid. This excavation was made across the whole distance. In this were trenches in which were placed logs spliced together at the ends and securely staked down. A mattress was then made upon an inclined scaffolding. Willow brush was laid on the scaffold, butt ends and tops alternating so as to be close together and bind well, there being enough large brush to hold the mass and enough small and short to fill all the space. None but assorted straight willow brush was used anywhere, those pieces with wide or spreading branches being cast away. This mattress, about sixty feet in width and two feet in thickness, was then sewed together with strong wire until it was pressed to one foot in thickness. The frame or scaffold was drawn from under by horses, and the dense mass sunk upon the stringers and was sewed down to them and otherwise securely fastened. Though the mattress was necessarily made in pieces, these were all sewed together at the ends, making it continuous. This was all covered with two feet of earth, and continued driving over it has packed the ground. This is intended to prevent the wash from the water that flows over or through the dam.

On top of the mattress and earth, but a few feet below the upper edge of it, begins a layer of logs laid together closely, sewed with wire and sewed to the mattress beneath. On this are stringers and then two more layers of logs, all with butts down stream and top ends running into the ground up stream. They were all secured in the same manner to the mass below and loaded with dirt. The line of the butt ends of each successive layer is further up stream, of course, forming a sort of stairway from the bottom. Earth and sand are used to fill all the crevices. The length of the dam is between 10,000 and 11,000 feet, or nearly two miles, and it averages eight feet in height. There is no part of it that is not firmly wired to every other part. Statistics are not generally very effective in description, but some idea of the way in which it is all matted together may be given by the statement that considerably more than 100 miles of wire has been used, and, independent of brush, there are in the structure just 117,400 logs, averaging six inches in diameter at the butt and thirty feet in length.

Though the distance between the highlands on either side of the basin is about two miles, the present channel of the river is comparatively narrow. To connect the two sections of the dam the channel had to be vacated by turning the course of the river by the construction of a wing dam of brush across the channel a quarter of a mile above the gap. The capacity of the first attachment basin is equal to 75,000,000 cubic yards of *débris*. When filled to the level of the dam, another dam will be built on the top of the first and so on.

A Gigantic Iron Pier Pound-net Proposed.

The Long Island Fish Company, of this city, proposes to engage in pound fishing on a scale hitherto undreamed of. Already a large tract of land has been purchased at the eastern end of Long Island, extending about a mile along the coast. At this point, which is eminently favorable for pound fishing, since the fish that run along the coast here come very close to the shore, the company propose to construct a gigantic weir supported by iron piles, forming an iron pier 700 feet long and ten feet wide, with bents or sections twenty feet long. At the outer end of the pier, in thirty feet of water, will be a heart-shaped pound, the large end of the heart inshore. This heart will be about seventy feet across, and outside of it is to be a box of iron piles and netting about seventy-five feet square. The fish coming from either direction and striking the pier netting will run out seaward to the heart, and, passing out at the lower end, will find themselves in the outer receptacle. In the sections of the iron weir storage for thousands of tons of fish can be provided, where they will keep alive in their native element for a month or longer, and need not be immediately brought to market when the price is low.

The great advantage of an iron weir lies in its stability and freedom from attacks by worms. The netting fence runs down to the bottom of the water so as to stop ground-swimming fish. The pound has a net bottom, and when filled with fish is lifted and the fish dipped out with hand nets.

Piers at French Ports.

The construction of a new pier has just been commenced at Nice, and it is expected that it will be finished and opened to the public in about two years from the present time. The total area of the pier and pier-head will be 65,000 square feet, and the piles at the pier-head will be in water varying from 26 feet to 33 feet deep. On account of the absence of the tide in the Mediterranean and the rapidly increasing depth of the water, the length will be 300 feet, but the building on the pier-head, according to a correspondent, will be larger, more substantial, and of a more ornamental character than is usually the case with English piers. It will contain a large central hall, or concert room, a restaurant, billiard room, and all other necessary adjuncts of a casino, and the arrangement of the bracing under the pier-head is especially designed to give ample space for two large swimming baths. Under the same auspices the construction of piers will soon be commenced at Cannes, Dieppe, and Trouville.

NEW INVENTIONS.

Mr. John C. Wharton, of Nashville, Tenn., has patented an improved shelving which is dust proof and exhibits the articles placed thereon to the greatest advantage, and is also ornamental. The invention consists in a series of shelves provided with glass fronts, forming closed boxes or compartments, which are arranged in such a manner that each shelf projects beyond the next lower one, thus permitting receptacles containing the article to be exhibited to be placed upon the shelves through apertures in the bottom thereof. The receptacles are provided with some suitable locking device for holding them on said shelves.

An improvement in electric lamps has been patented by Mr. John H. Guest, of Brooklyn, N. Y. The object of this invention is to furnish means for automatically regulating the length of the arc in electric lamps, and to prevent fluctuations in the light by changes in intensity of current. It consists, primarily, in a thermoscopic rod combined with an electric lamp for expansion according to the intensity of the current and resistance in the circuit. The lineal expansion is multiplied by levers, which act by clamps to separate the carbons.

Messrs. Robert Quintavalle and Theodore Lindberg, of Brooklyn, N. Y., have patented an improvement in the class of fire escapes adapted to be suspended from a window of a building. It is more particularly an improvement upon such apparatus as consists of a frame that is designed to be attached to a window-sill, and is provided with a curved standard, from which a basket or other receptacle for persons and goods is suspended by means of a rope running through a sheave or pulley block.

Mr. George Oliver, of the City Road, County of Middlesex, England, has patented an improved apparatus for enabling a performer to ascend to or descend from a considerable height from a stage or platform, either in a vertical or oblique direction, as may be required, or for personating a bird, for instance, or other character suspended in mid-air.

An improved clasp for pocketbooks, satchels, etc., which is simple and convenient, has been patented by Mr. John G. Klett, of Brooklyn, N. Y. The invention consists in a spring plate provided with a knob or button, and with flanges on the opposite ends, one of the flanges being securely attached to one part of the frame of a pocketbook, satchel, etc., while the other catches on a stud on the other part of the frame, or catches on the edge of the frame itself.

An improvement in stereotype casting boxes has been patented by Mr. William E. Gump, of Brooklyn, N. Y. The object of this invention is to secure adjustable gauges to a casting box, and do away with the separate frames between the lids of the box, so as to save time, labor, and cost.

An improved oil stove wick-trimmer has been patented by Messrs. Martin W. Walker and George E. Williams, of Sing Sing, N. Y. In ordinary oil-burning stoves it is necessary to remove the top of the stove and the utensils on it to trim off the crust that forms on the wicks and interferes with the proper action thereof. The object of this invention is to avoid the inconvenience attendant upon this process of removing the crusts on the wicks.

Mr. Conrad Blattner, of St. Louis, Mo., has patented an improved permanent roll for a detachment of troops, the members of a police force, or other organized body, designed to indicate at a glance the absence, presence, physical condition, character of duty engaged in, etc., of each and every member of the body.

An improvement in dental forceps has been patented by Mr. William P. Tisdale, of Pass Christian, Miss. The invention consists in a rod bifurcated at one end and a rod that has a head embracing the elastic prongs or bifurcations, so as to open and close the jaws which form a part of the prongs, the slide rod being operated by a hand screw.

Mr. William J. Ormsby, of Cincinnati, O., has patented an improvement in that class of air-carbureters in which the tank or reservoir containing the gasoline or other carbureting liquid is placed above but in communication with the pans or trays intended to receive from time to time a limited portion of the liquid, and through which the air to be carbureted is successively passed.

An improved device for removing vitiated air from dwellings and other buildings by the vacuum process, has been patented by Mr. James F. Baldwin, of Lockport, N. Y. It is adapted for connection with a stove, stovepipe, or flue, and may be placed on the floor or otherwise suitably arranged within the room to be ventilated, and the air is drawn into it and it passes into the pipe, a current being induced by the draught in the chimney.

An improved machine for crushing, grinding, and pulverizing the valuable ores in order that by comminution the metallic portion may be separated from the gangue, has been patented by Mr. Royal C. Grant, of Middleport, O. This machine is of that class in which a tapering or cone-like shell revolves around a core of corresponding shape.

A cheap, simple, and efficient apparatus for generating or producing illuminating gas, has been patented by Mr. Geo. H. Burrows, of Somerville, Mass.

Mr. John Q. Crosby (Hezekiah H. Crosby, administrator), of Yonkers, N. Y., has patented an improvement in the class of reels having an iron frame provided with pivoted braces or legs adapted to be folded for the purpose of transportation, etc. The invention relates to the construction of and means for locking the reel proper or the revolving part on which the hose is wound; also, to the construction of the holder for the nozzle of the hose.

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.

(1) T. S. & S. ask: How can we make a brass solution that will plate a fox gold color, to be plated on rough cast iron? A. Water (soft), 14 pints; bisulphite of soda, 7 oz.; potassium cyanide, No. 2, 17 oz.; carbonate of soda, 34 oz.; add water, 3½ pints; acetate of copper, 4½ oz.; neutral zinc chloride, 3½ oz. If the deposit is too red use more battery; if too white, less; if earthy or ocherous, add more cyanide; if dull and unequal, add a little arsenious acid to cyanide. They both usually need more or less correction when fresh, it improves on working. Use brass anodes and a pretty strong battery. 2. How to make an electrotyping solution? A. Use a nearly saturated solution of sulphate of copper in soft water. The following gives better results when manipulated by a skilled plater: Bisulphite of soda and pure cyanide of potassium, each 18 oz.; carbonate of soda, 36 oz.; acetate of copper, 17 oz.; aqua-ammonia, 12½ oz.; water, 5½ gals.

(2) D. D. writes: I have a lot of waste hard rubber. Can you tell me how to utilize it? Can I make any preparation that will dissolve it so that it will harden afterwards? A. We know of no solvent for the rubber. It is of little use except to the rubber manufacturer, who utilizes it, when ground, to mix with fresh stock.

(3) C. W. D. asks if there is any method of determining how many horse power of steam is passing through a pipe of certain size, the steam pressure being known, the steam used for heating purposes, and thrown into well when condensed; in other words, is there any rule or gauge that will determine what horse power will pass through a pipe of given size, at given pressure, valve full open, and used as above indicated? A. The flow of steam cannot be measured by the horse power, and if so, it would not apply to heating surfaces, as the velocity of flow must depend upon rapidity of condensation; in other words, it will be greatest in coldest weather.

(4) C. & S. ask: What size air pump should we use for a vacuum pan of 200 gallons capacity, temperature used 42° C.? A. Air pump 10 to 12 inches diameter, and 6 or 7 inch stroke, with steam cylinder 7 inches to 8 inches diameter.

(5) F. H. B. asks for a recipe for making a good cologne. A. Oils of lemon, cedrat, and bergamot, each ℥iij.; oils of lavender, rosemary, and neroli, each ℥iss.; oil of cinnamon, ℥vj.; rectified spirit, 3 gals.; spirit of rosemary, 1 quart; compound spirit of balm (eau de melisse des carmes), 3 pints. Digest for eight days, then distill 3 gals.

(6) C. J. H. writes: In making quantitative blow-pipe assays of gold and silver ores, charcoal is recommended for a support in the first fusion of the assay. It is often quite difficult to procure good coals for the purpose, especially when on a prospecting trip. Is there not some kind of material from which small capsules can be made for the purpose, which can be used an indefinite number of times, and which would be equally as good as charcoal? A. We know of no support that will serve as a good substitute for the coal. A small bone ash cupel will answer in some cases.

(7) A. H. L. asks: Will you please specify the kinds of pitch and gutta percha to be used in making cement, also the manner of melting them together? A. Burgundy pitch, melt in an iron pot with as little heat as need be, and stir constantly. The addition of a little shellac will harden it somewhat.

(8) W. W. F. asks: 1. Can you give me a list of the best practical books on the manufacturing of chemicals and dyestuffs? A. Consult Wagner's "Chemical Technology," Watts and Richardson's "Acids, Alkalies, and Salts," and the U. S. Dispensatory and Pharmacopœia. 2. Give the best manner of making an acid solution of bisulphide of soda, with the difference between a bisulphide and a sulphide and a sulphate of soda. A. Acids precipitate the sulphur from the alkaline sulphides. The sulphide may be prepared by boiling together with water for an hour 2 parts of sulphur and 2¾ parts carbonate of soda. Concentrate to small bulk by evaporation, cool, and pour off the liquid from the solid bisulphide. The bisulphide differs from the sulphide only in the large proportion of sulphur it contains. A sulphate is a combination of sulphuric acid with a base, while the sulphide is a compound of sulphur with the same. Consult some elementary book on chemistry, such as Fownes'.

(9) J. W. W. writes. I have a 20 inch by 28 inch engine, taking steam from steam drum 44 inches in diameter, placed across three flue boilers each 44 inches diameter, 30 feet long. Would I get more power out of a 36 inch steam drum; if so, why? A. No: but you would probably get drier steam, which would be an advantage.

(10) G. B. S. asks: In which bearing would a journal run with the least friction, one of one inch in length, or one of three inches in length, other conditions being the same in both cases? A. There would be no difference if the shaft was strictly in line, and the pressure low enough not to approach abrasion of the shorter journal; but the boxes of the longer journal would wear the longest, as the friction would be distributed over a greater surface.

(11) J. F. B. asks: 1. What would be the best mortar to lay fire brick in for lining the fireplace, and flue from a large boiler? A. Fire-clay mortar. 2. What is the highest chimney in the United States and what the height? A. There is one in the vicinity of Pittsburg 275 feet high. We cannot say whether this is the highest. 3. In building a horizontal flue of brick, and lining it with an air space left between, is there any sandstone or other stone that will stand heat well enough to use for lining on bottom and top of flue, and if so, where could it be had? A. Stone is not adapted to this purpose. 4. In building chimneys 300 feet high or higher what mortar is it proper to use outside and inside? A. For outside work hydraulic cement; for inside work, good lime mortar. 5. What coefficient is the most reliable to use for linear expansion of brick work exposed to great heat? A. Clark gives for stock bricks, not laid up, for each degree 0·00141 of an inch in 100 feet length. 6. Knowing the amount of grate surface feeding a chimney, what rule will best determine the necessary inside diameter and height for the chimney to give best results? A. Consult "Wilson on Boiler and Factory Chimneys."

(12) E. B. V. writes: 1. To R. L. J. (2), December 18, 1880, you give ink recipe same as in SUPPLEMENT No. 157. Can you translate the first into a cold process recipe? A. Heat is necessary to properly extract the tannin from the galls. One-seventh the weight of the galls in commercial tannic acid will make a similar ink not requiring heat. 2. After digesting the galls by either the hot or cold process, and a clear solution obtained, which product will retain longest its original excellence in the bottle and black color on the written page, a suspended ink with gum arabic, or a solution with sulphuric acid? A. The fluid or true solution under ordinary circumstances. 3. In recipe above mentioned, would a little blue or purple aniline, soluble in water, replace the extract of logwood equally well as to quality? It would give a pleasing color. A. If you can make it stay in solution, yes. 4. Does the permanganate or any other disinfectant absolutely prevent or only hinder mould; that is, does the dissolved disinfectant remain such, and continue to act while there is fluid about it, or does it evaporate, change, or otherwise become neutral with age? A. The permanganate is not used as a disinfectant in this connection; it serves to oxidize the iron salt and render the ink darker when first written with. It suffers decomposition in the reaction.

(13) C. O. M. writes: I wish to take a copper plate, and either print or mark upon it, then apply some acid that will eat away the copper except where I have marked, so that I can print with it. A. Digest coarsely powdered resin with about twice its volume of spirit of turpentine in a bottle immersed in hot water for twelve hours or so; cork very loosely, and shake occasionally; color with lamp black or printer's ink. Apply with a camel's hair brush or pencil, and let stand over night to dry and harden. Use nitric acid diluted with about three parts of water. 2. How can I take an electroplate of a form after it is set up? A. Take a wax or plaster cast of the form, coat it evenly with pure graphite or plumbago, connect by a copper wire with the zinc pole of a battery, and suspend in a strong solution of sulphate of copper in water, facing a plate of copper also suspended in the liquid and connected with the copper or carbon pole of the same battery. The connection between the wire and the film of graphite must be very perfect and secure. When the operation is properly conducted copper deposits over the film of graphite, copying the impression perfectly. When the film of copper is thick enough, it is dried, backed up with a fusible alloy or solder, removed from the mould, trimmed, and mounted on a block.

NEW BOOKS AND PUBLICATIONS.

VENNOR'S ALMANAC FOR 1881.

Twenty-five cents sent to the American News Company, New York City, will insure the receipt of a copy of the Prophet's almanac, containing his weather predictions for the entire year.

THE MAGAZINE OF ART. Monthly. $3.50 a year. Cassel, Petter, & Galpin, New York.

The December number of this superbly illustrated art journal contains engravings of a variety of artistic subjects, consisting of bronzes, armor, celebrated oil paintings, and remarkable architectural structures.

THE ART INTERCHANGE. Fortnightly. $2 a year. Arthur B. Turnure & William Whitlock, editors and publishers, 140 Nassau street, New York.

This publication is devoted to household art and indoor decorations in all its branches. The subjects are illustrated to a generous extent, and the hints and directions the editors give for producing a great variety of ornamental and useful articles renders it a desirable fireside magazine. The Christmas issue just out is an attractive number. Sent by mail for 25 cents.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

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

December 7, 1880,

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 one dollar. In ordering please state the number and date of the patent desired and remit to Munn & Co., 37 Park Row, New York city. 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.

Air compressor, E. A. Rix 235,296
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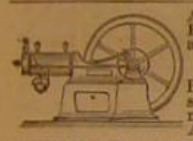

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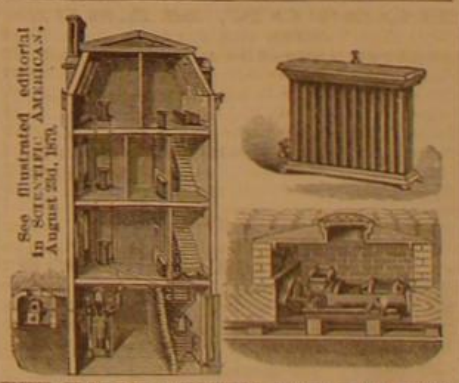

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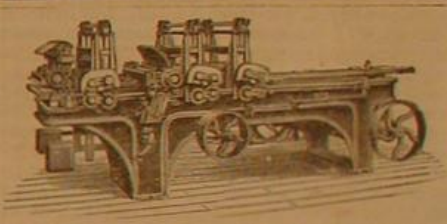

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PROGRESS OF THE BROOKLYN BRIDGE.

The several views of the New York approach to the East River Bridge, shown below, will give a better idea of the magnitude and present condition of this portion of the great work than any amount of verbal description.

At this writing but one small arch of masonry lacks completion. The only other gap in the magnificent viaduct is at Franklin Square, where Pearl street is to be spanned by an iron bridge, and it is probable that the contract for this portion of the work will have been given out before these lines are printed.

The construction of the superstructure of the main bridge has been delayed, owing to the grave difficulties encountered in producing and shaping the steel. The trusses called for larger bars of steel than had ever been produced in this country, and special machinery had to be constructed for the purpose. And when this had been done it was found that much greater engine power than had been anticipated was required for the rolling of the bars. Another source of delay was the different behavior of steel from iron while in process of shaping, necessitating repeated alteration of the rolls before some of the more difficult forms and sizes could be exactly and uniformly produced. All these engineering and mechanical difficulties have now been surmounted; all the forms and sizes that the structure will require have been made, and are now being delivered more rapidly than the material can be used. It is expected that a large stock of material can be accumulated in the yards by the piers during the winter months, so that as soon as the weather will permit the erection of the superstructure of the bridge can be pushed with the utmost speed.

The great cables and other supporting elements of the structure are complete and ready for the attachment of the superstructure with its suspenders and stays. For some distance on each side of the towers the suspenders are already in place; and it is probable that during the remaining winter months several forty-foot sections of the truss work will be swung into position landward and riverward from each of the towers; but it will scarcely be prudent to push the work further until the stormy season is at an end. The erection of that portion of the superstructure within the towers will be begun the first week in January.

NEW YORK APPROACH TO EAST RIVER BRIDGE.

By the beginning of spring, unless some altogether unexpected disaster occurs, here or at the steel works, there will be in readiness a sufficient amount of material to allow the work to be pushed with the utmost rapidity. Four gangs of men will be employed at each tower, two building shoreward and two toward the center of the river. In this way the increasing strains upon the towers will be equalized, and the lengthening structures on either side kept properly balanced. The material will be raised at the towers, and conveyed to the extremities of the working on temporary railways.

With the facilities which are at command for handling the material, and the large number of men that can be employed, the engineers are confident that the five thousand tons of metal which the superstructure will require can be put in place during the next twelve months.

The timber for the wooden portion of the roadway is now being prepared by a process of creosoting. No official action has yet been taken with regard to the means to be employed in handling passengers and freight; it is probable that a cable system, similar to that in use in San Francisco, will be adopted.

The Rose of Jericho.

At the last meeting of the Royal Botanic Society, Professor Bentley called attention to the peculiar properties of the so-called Rose of Jericho, pointing out that during the dry season it becomes coiled up into a ball, and is blown about the dry, sandy deserts of Egypt and Syria for many months; but at the first shower of rain its leaves expand, and it becomes apparently revivified as if its life were renewed. If placed in water, or in moist sand or earth, it opens out in a similar manner; and it is so sensitive to moisture that it indicates by similar changes in its leaves the presence or absence of moisture in the atmosphere, and thus acts as a natural vegetable hygrometer, in the same way as a bunch of seaweed will become hard and dry in fine weather, and soft and leathery in damp or rainy weather. In this case it is the salt which is present in the leaves that is acted on; and it is quite possible that a similar explanation of the phenomenon in the case of the Rose of Jericho might be found if the plant were subjected to careful analysis. As the first Rose of Jericho was brought to England as long ago as 1597, it is time that the cause of its curious properties was discovered. The rose has been called a vegetable barometer; but this is evidently incorrect, as it is influenced by the bygrometric and not the barometric state of the atmosphere.

The Steam Engine Governor.

The great importance of strong and efficient steam engine governor connections is illustrated by the fatal accident which took place Nov. 18, at Messrs. Howard and Bullough's iron works, Accrington, Eng. It appeared at the inquest that one of the bevel wheels which drove the governor had broken, and the consequence was that the engine "ran away." The men in the grinding shop ran out of the place, and they were followed by those in the smiths' shop, and from all parts of the works. Five grindstones flew to pieces, and the fragments were hurled through the roof and fell on to the smiths' shop, demolishing a portion of that roof. One piece, weighing about six cwt., flew half the height of the chimney and alighted on an anvil, behind which a smith was at work. The man who was killed was sharpening an axe, and did not make off when the other men did. Some very narrow escapes took place. The engine ran for three minutes after the steam had been shut off, and turned all the shafting. The engine tender was at dinner at the time the accident occurred.

Hot Sand a Good Bed Fellow.

The comfort which a hot water bag or even a hot brick may afford a person on retiring, chilled, is very great, and beyond this, the use of some such warmth-producing appliance is useful as a health preservative and restorative. But one of the most convenient articles to be used as a bed warmer and in a sick room is a sand bag. Get some clean, fine sand, dry it thoroughly in a kettle on the stove, make a bag about eight inches square of flannel, fill it with the dry sand, sew the opening carefully together, and cover the bag with cotton or linen cloth. This will prevent the sand from sifting out and will also enable you to heat the bag quickly by placing it in the oven, or on the top of the stove. After once using this you will never again attempt to warm the feet or hands of a sick person with a bottle of hot water or a brick. The sand holds the heat a long time, and the bag can be tucked up to the back without hurting the invalid. It is a good plan to make two or three of the bags and keep them ready for use.

Telegraphic Progress in China.

The U. S. Consul-General at Shanghai, China, informs the State Department at Washington that the Emperor of China has given permission for the construction of a telegraph line from Shanghai to Tientsin, a distance of 1,200 miles. The route will be from Shanghai to Chinkiang, thence along the line of the Grand Canal to Tientsin. A short line of about 70 miles will also probably be constructed by the Viceroy at Nankin to connect the capital of his province with the main one at Chinkiang. The work of setting the poles and laying the wire will be begun early next spring. It is estimated that the work will cost $500,000.

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NEW YORK, SATURDAY, JANUARY 15, 1881.

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(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT
No. 283,
For the Week ending January 15, 1881.

Price 10 cents. For sale by all newsdealers.

PROGRESS OF THE BRUSH SYSTEM OF ELECTRIC LIGHTING.

The ancient saw anent the share of milk obtained by the still suckling seems to be pretty well borne out in the progress of the Brush system of electric lighting. A dozen systems, so-called, have made more noise and have attracted more newspaper attention; but while they are for the most part still "promising," the Brush system has been quietly taking possession of the field. How far this is due to the superior business management of the company controlling the Brush patent it is impossible to say; the indications are, however, that the remarkable success of the Brush system is mainly due to the practical genius of Mr. Brush in meeting the requirements of outdoor or large room lighting with an efficient generator, and a lamp which is so simple in construction, so automatically regular in action, and so easy to keep in order, that practical business men can afford to use it. It is perhaps the least ornamental in appearance of all lamps, but it gives the light required, and calls for comparatively little care. On the score of economy the users of the lamp profess to be well satisfied; and the rapid and largely extended adoption of the system, abroad as well as at home, would seem to justify the favorable judgment which those who have tried the lamp have freely expressed with regard to its practical value.

The latest list of prominent users of the Brush light embraces twenty-five rolling mills, iron and steel works, machine shops, car works, wire works, and the like; twenty saw mills, paper mills, oil works, printing houses, and other factories and manufacturing establishments; twenty woolen, cotton, linen, and silk factories, several of them employing over a hundred lights each; a dozen mines, smelting works, etc.; more than a dozen large wholesale and retail stores, using from six to sixty-four lights; a dozen public parks, docks, summer resorts, and the like, including a mile and a half of river front and docks at Montreal; circuses, colleges, hotels, steamers; and large numbers of city lights in San Francisco, St. Louis, Chicago, Cleveland, Detroit, Grand Rapids, and other cities, besides New York and Brooklyn, where a hundred or more lights are already in use. The contracts of the company in San Francisco called for the erection of about a thousand lamps by the beginning of the current year. Wabash, Indiana, claims the credit of being the first large town to adopt the electric lamp for general illumination, four Brush lights, of 3,000 candle power each, on the court house dome, sufficing for the outdoor needs of the entire town of 10,000 inhabitants.

The company formed in London to introduce the Brush light there have already placed two hundred lights in various parts of the city, and have ordered from Cleveland nearly as many more, contracts having been signed for the lighting of the Houses of Parliament, Charing Cross Station, Ludgate Hill Station, Blackfriars' Bridge, St. Paul's Churchyard, and other conspicuous places. Even the extremely conservative British Admiralty has taken kindly to the Yankee invention, 432 lights having been purchased for the use of the Royal Navy. Mr. Brush is now making a 40-light machine (80,000 candles) designed to throw the entire current into one huge lamp, which has been ordered for the British torpedo service. The carbons for this artificial sun will be as large as a man's arm, and the light, when directed by a projector of corresponding size, will of itself be a formidable weapon of defense. With a proper system of curtains it will be possible to flash upon an approaching enemy a sudden glare of light that will be little less than blinding.

A less imposing but more admirable application of this light, and one that is being rapidly adopted, is in connection with locomotive headlights. The generator is operated by a small engine taking steam from the boiler and placed opposite the air compressors of the Westinghouse brakes. By attaching the reflector to the forward truck the light may be thrown so as to illuminate the track ahead even when rounding curves. It is obvious that the same machine which supplies the headlight will also furnish a current for illuminating the cars.

Wherever the electric light has been brought fairly into competition with gas for lighting large rooms or open spaces, it has given a good account of itself in comparisons of cost. In very many cases, however, any comparison with gas is out of the question. With gas it is simply impossible to do certain kinds of work at night, or to do it as rapidly and well as by daylight. With the electric light night production is brought up to the level of day production. The gain of one night's increased production will often pay the cost of electric lighting for months. Practical business men are not slow to appreciate advantages of this sort. The question with them is not how much will the electric light cost, but can the light be depended on for steady, uniform, certain operation, without requiring too much expert attention? The ability of the Brush lamps to meet such practical requirements would seem to be the secret of its substantial progress.

ON AIDS TO HEARING.

Until within a few years the old-fashioned ear trumpet was the sole reliance of deaf persons as an aid to hearing, but since the invention of the telephone much more attention has been given to the subject of sound, its production, and distribution. Especially after the public announcement of the misnamed microphone and its ability to enable a person to hear a fly walk at a distance of a mile or more, was the attention directed to devices for the benefit of deaf persons,

and there at once arose a crop of various species of *phones*, such as the *audiphone*, the *dentiphone*, and so forth.

They have one and all failed in their purpose, being quite inefficient compared with the ear trumpet. The reasons for the failures will be plain to one who considers what the physical conditions must necessarily be.

Whenever a sound is produced in free air, the latter immediately diffuses it in every direction, the sound wave assuming a spherical form and traveling outward with a velocity, generally upward, of eleven hundred feet in a second.

Now, the strength of the sound, or in other words its energy, is proportional to the square of the amplitude of vibration, and as diffusion goes on the energy is proportionally spread, so that at a double distance the intensity is but one-fourth the original intensity. Secondly, whenever a sound wave strikes upon any surface whatever it is reflected in part as an echo and in part is absorbed; that is, the body presenting the surface is itself made to vibrate, and generally the loss by reflection is as much as one-half of the energy.

Now, what is specially wanted is to bring the vibrations with their utmost energy into the ear so as to shake the appropriate bones there. In a normal ear there is energy enough in the small part of the spherical sound wave that reaches the membrana tympani to make hearing easy; but if for some such reason as a thickened membrane more energy is required to make it vibrate properly, the way to do it is either to bring the source of sound nearer to the ear, so that it shall receive the largest possible part of the spherical wave, which will be when the source of sound, say the mouth, is immediately at the conch of the ear—nothing will likely surpass that for intensity—or else, by some special device, prevent the sound from spreading in the air, and directing the wave with all its intensity into the ear, as though the mouth were at the ear.

In the light of these principles how is it with the audiphone? A more or less elastic surface is held by its edges between the teeth and hand, and some tension given to it by curvature. Of sound vibrations made in its neighborhood it receives its proportionate part of the spherical wave, of which, certainly, half will be reflected, another part will be received by the hand and lost, while the remainder will be distributed, first, to the teeth, and from them to the whole skeleton, the ear getting but a small part. Still, as the ear, even a defective one, is a marvelously sensitive organ, there may be energy enough in the vibrations that are made in this abnormal and roundabout way to enable one to hear what is said.

Any device for getting sound vibrations to the ear by the way of the bones must necessarily have these diffusive defects. None of them can bring to the ear the sound vibrations with their maximum amplitude. The ear trumpet comes nearer to the necessary conditions than anything that can be proposed; for, first, if the bell be spoken into there is no appreciable loss by reflection nor from scattering, that is, the spherical wave is not formed as it is in free air; and, second, the tube opens near to the membrana tympani, and the whole energy of the sound is spent on that.

If, however, the passage to the tympanic membrane be nearly or quite closed by the thickening of the mucous membrane, then the ear trumpet will be nearly or quite useless, as it would also be in the case of a tympanic membrane that was either too thick to respond or too flabby. In the former case nothing would be heard, and in the latter articulation would be very defective; but in general, when these abnormal conditions are not present and one cannot hear with an ear trumpet, other devices will be of no service, for the trouble is with the auditory nerve, and the judgment of a skillful aurist should be obtained in any case. When the nerve is unimpared and the passage to the tympanic membrane is closed, it is possible for one to get some help from some form of the dentiphone; but for reasons already given one must hope but for small service from any of them. In most cases of deafness the ear trumpet is much the most efficient.

Many persons, however, are only slightly deaf, who need some aid, to whom an ear trumpet would be highly objectionable, and who would be glad of some substitute. For such persons it is well to know that the common string telephone answers well.

Theoretically it fulfills the conditions. The transmitter prevents the formation of the spherical wave to any extent, the string prevents the scattering, while the receiver fits close to the ear, and it may have an appropriate tube to enter the tympanum, in which case there is really but a very little loss. The common ones of the market costing but ten cents a pair answer every purpose. The thread need not be but two or three feet long, and the whole may be carried in the pocket. I have personally experimented with these upon deaf persons, and am assured by them that they are much helped by their use. One may talk with such a deaf person with ordinary loudness and be easily understood, when, without it, what is said must be said so loud as to be heard in distant parts of the house. A year or two ago I tried to induce a manufacturer in Boston to make for the market some of these instruments specially adapted to the wants of deaf persons, but the reply was that if made so small they could ask but a small price for them, and the demand was not enough to make it a profitable investment; but larger ones (for a show of cost) were made for business purposes, and five dollars a pair was asked. But, as said before, cheap ones are just as efficient and much more portable.

HARVEST FIGURES.

A good many curious calculations have been made in connection with the enormous crops of wheat produced by the Dalrymple farm in Dakota. A correspondent of the Chicago *Inter Ocean* has been indulging in some new ones relative to the last harvest. From the speed of the harvester and the length of the cutting-bar he calculated that there would be 900 bundles to the acre, or seventy-five shooks of twelve bundles each. As there were 18,000 acres in the field the shooks numbered 1,350,000, and the bundles 16,200,000. Allowing thirty inches of wire to the bundle, over 7,670 miles of wire were needed for binding the crop—almost enough to reach through the earth.

PROFESSOR GAMGEE'S ICE MACHINE.

A press dispatch from Washington, dated December 22, gives a very amusing report of an exhibition of an ice machine at the Navy Yard the day before. The report states that "the great novelty of the apparatus consists in the utilizing of heat which all others waste, and the liquefaction of ammonia by expansion. Almost immediately after the machine was started a temperature of nearly zero was obtained. Chief Engineer B. F. Isherwood, in an interview with Professor Gamgee, recognized the correctness of the principle, which had now been demonstrated to be sound by actual test. The heat of southern climes, the Professor maintains, will henceforth prove no obstacle to cheap ice making, since where there is most heat, by his new system, there is most available energy wherewith to drive the machine. The consumption of coal is thus reduced to a minimum. This fact was recognized by the Board of Naval Engineers, who reported favorably on Prof. Gamgee's plans for the refrigerating ship."

Heretofore it has been held to be established, both in theory and in practice, that it costs more to freeze warm water than cold water. Given water at 32° Fah., a certain amount of heat has to be withdrawn before the water will congeal. To withdraw this heat artificially costs money, both for power and for water to carry off the heat withdrawn. With every degree of heat which the water shows above 32° Fah., more heat must obviously be withdrawn, and a larger volume of waste water will be required to carry it away before the water operated on can be frozen. Thus, even if the waste water costs nothing, the increased power required in freezing the warmer water must increase by so much the cost of the ice. This is as certain and plain as the familiar fact that it costs more to draw a load up hill than on a level. The report claims that where the heat is greatest there is the most available energy for ice making, which is equivalent to saying that he can use the load on his wagon to propel the wagon up hill.

How Far Does the Sound of Cannon Travel?

To the Editor of the Scientific American:

The battle of Bunker Hill was fought June 17, 1775. The sound of the cannon used in the engagement was distinctly heard by persons on the Deerfield River on the east side of Hoosick Mountain, where now is the town of Charlemont, Mass., the distance being one hundred and twenty miles. This is asserted in "The Memoirs of Capt. Lemuel Roberts," a rare work, printed at Bennington, Vt., 1809. Capt. Roberts was an officer in the army of the revolution. He says: "We were surprised at the hearing of a heavy cannonade from a great distance, which proved to be the battle of Bunker Hill." P. 27.

On July 29, 1812, a naval engagement, with a cannonade lasting an hour and a half, occurred between the United States Flotilla of Delaware, Lieut. Samuel Angus commanding, and some British ships that were in the bay. The conflict transpired near Cape May, not far from a place called Crows Shoals. The firing of the cannon was heard by many persons at Washington city, the distance of which from the scene of action in a direct line is one hundred and twenty miles. This is recorded as "A Curious Fact" in Vol. 2, No. 9, page 40, of *The War*, published weekly at New York, 1812–13.

These cases are well authenticated. The cannon could not have been so large as those now in use. Are there similar instances on record? And how far distant can the report of the heaviest cannon be heard? D. T. TAYLOR.

Hyde Park, Mass.

ELECTRO-METALLURGY.

COPPER DEPOSITS.

Where it is intended to simply coat or plate another metal or alloy, the electro-deposit of copper is usually obtained by the decomposition of a double salt, such as the cyanide of copper and potassium. This process is adapted to most metals, and affords a fine uniform deposit. The following is a good bath of this description:

Water (soft)	1 gall.
Acetate of copper (cryst.)	3½ oz.
Carbonate of soda (cryst.)	3½ "
Bisulphite of soda	3 "
Cyanide of potassium (pure)	7½ "

Moisten the copper salt with water to form a paste (otherwise it is apt to float on the liquid); stir in next the carbonate of soda with a little more water, then the bisulphite, and finally the cyanide with the rest of the water. When solution is complete the liquid should be colorless. If not, add cyanide until it is.

The bath may be employed hot or cold, and requires a moderately strong circuit of electricity. A copper plate forms the anode, and it should expose surface enough to supply the loss of copper—at least a surface equal to that of the work. It must be removed when the bath is not in use.

If the liquid becomes colored, more cyanide must be added.

Large pieces are generally kept hanging motionless in the bath while the plating is in progress; small articles are moved about as much as possible, especially if the bath is warm.

The formula for the bath given above requires pure cyanide of potassium, and where the commercial article, which is often very impure, is used instead considerable allowance must be made. The following formulæ require a cyanide containing 70 to 75 per cent (a good average) of pure potassium cyanide:

COLD BATH FOR IRON AND STEEL.

Acetate of copper	3 oz
Carbonate of soda	6½ "
Bisulphite of soda	3½ "
Cyanide of potassium	3½ "
Water	1 gall.
Aqua ammonia	2½ fl. oz.

Prepare as before.

WARM BATH.

Acetate of copper	3½ oz.
Carbonate of soda	3½ "
Bisulphite of soda	1½ "
Cyanide of potassium	4½ "
Water	1 gall.
Aqua ammonia	1½ fl. oz.

HOT OR COLD BATH FOR TIN, CAST IRON, OR LARGE ZINC PIECES.

Acetate of copper	12½ oz.
Bisulphite of soda	10 "
Cyanide of potassium	18 "
Water	5½ gall.
Ammonia (aqua)	7 fl. oz.

For small articles of zinc, which are coppered in a perforated ladle and in nearly boiling baths:

Acetate of copper	16 oz.
Bisulphite of soda	3½ "
Cyanide of potassium	25 "
Aqua ammonia	5½ "
Water	4 to 5½ galls.

In the preparation of these baths the salts are all dissolved together, except the copper acetate and ammonia, which are added after dissolving together in a small quantity of the water.

The deep blue color of the ammonio-copper solution should entirely disappear on mixing it with the other solution; otherwise, it becomes necessary to add more cyanide.

The cold bath is put into well joined tanks of oak or fir wood, coated inside with gutta percha or asphaltum (genuine). The vertical sides are also covered with sheets of copper, all connected with the last carbon or copper of the battery by a stout copper wire with well-cleaned ends, the other pole of the battery being in similar connection with a stout brass rod extending the length of the tank (without any point of contact with the anodes), and from which the work is suspended by hooks or trusses in the bath.

With a thin deposit the coating is sufficiently bright to be considered finished after being rinsed and dried, but if the operation is more protracted the deposit has a dead luster on account of its thickness, and if a bright luster is desired it is necessary to use the scratch brush.

The hot baths are usually put into stoneware vessels heated by a water or steam bath, or into an enameled cast iron kettle placed directly over a fire. The vessels are lined inside with copper, the edges of the vessels being varnished or support a wooden ring upon which rests a brass circle connected with the zinc pole of the battery. The objects to be electroplated are suspended from this ring.

The hot process it more rapid than the cold, and is especially adapted to those articles which are difficult to cleanse. The articles are kept in continual agitation, which permits of the employment of a strong current of electricity. Small articles of zinc are placed in a perforated stoneware or enameled ladle, at the bottom of which is attached a copper wire which is wound up around the handle and connected with the zinc pole of the battery. It is sufficient that one of the small articles touches the wire for all to be affected by the current, as they are in contact with each other. The ladle must be continually agitated, so as to change the points of contact of the objects. What has been said in regard to strength of battery, in the article on electro-brass plating, will apply here.

COPPER DEPOSITS BY DIPPING.

This is seldom practiced except upon iron, as deposits thus obtained are generally wanting in lasting qualities, since, from the thinness of the coating, the iron is but imperfectly protected from atmospheric influences. If the iron is dipped in a solution of—

Sulphate of copper	3½ oz.
Sulphuric acid	3½ "
Water	1 to 2 galls.,

it becomes covered with a coating of pure copper, having a certain adhesion; but should it remain there a few minutes the deposit becomes thick and muddy, and does not stand any rubbing. Small articles, such as pins, hooks, and nails, are thus coppered by tumbling them for a few moments in sand, bran, or sawdust impregnated with the above solution diluted with three or four volumes of water.

ELECTRIC EXHIBITION, PARIS.—It is proposed to hold an International Exhibition and Congress at Paris in 1881.

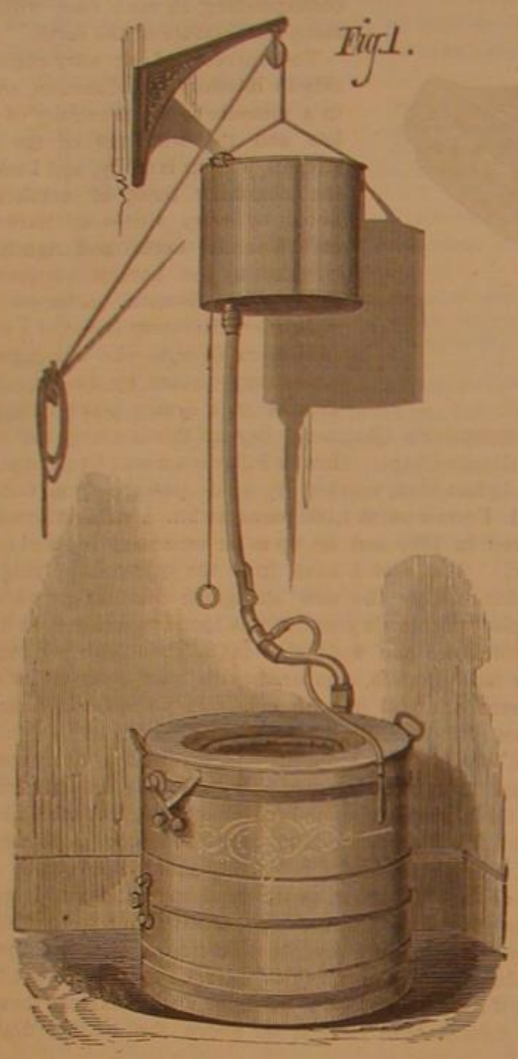
PORTABLE FOUNTAIN WATER CLOSET.

The article shown in the annexed engraving is one that should form a part of the furniture of every house, and is especially valuable for invalids and the aged. It is also a great convenience for persons in health, particularly in the country, in cold and inclement weather and at night; and as a sanitary provision it will prove beneficial in several ways. It will permit of a prompt obedience to nature's laws, and thus save both health and the cost of medicines and medical attendance. It is perfectly air tight, and is consequently odorless. It is readily moved from one room to another, and if it becomes necessary to pack it for storage or for transportation, all of the parts may be placed in its lower casing.

The inventor has arranged the fountain in connection with the lower portion of the casing, so that it may be used as a shower bath, a perforated nozzle being provided for this purpose.

The device is contrived so that it may be concealed in

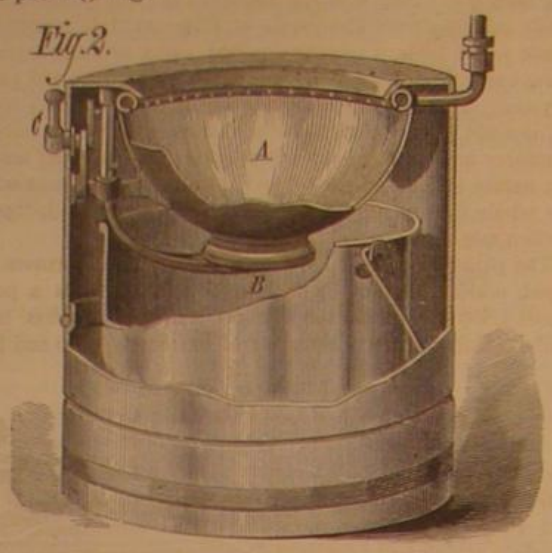
Fig. 1.



PORTABLE FOUNTAIN WATER CLOSET.

an ottoman or easy chair. The bowl, A, is furnished with a circular perforated pipe at the top, through which water is admitted from the flexible pipe connected with the fountain. The valve, B, at the lower end of the bowl is operated by the lever, C, which when raised first drops the valve, then swings it to one side. When this lever is depressed it first brings the valve under the bowl and then raises it up against the soft rubber packing at the bottom of the bowl. The joint between the bowl and valve is practically air tight, and the water always left in the bowl seals the joint perfectly. All other joints in the apparatus are sealed with flexible rubber packing rings.

Fig. 2.



PORTABLE FOUNTAIN WATER CLOSET.

In connection with the fountain an enema jet is provided, which can be used without the slightest inconvenience.

We are informed that a number of these closets have been in use in cottages at watering places and in other summer resorts, giving great satisfaction. They also attracted a great deal of attention at the late Fair of the American Institute, and were awarded a diploma.

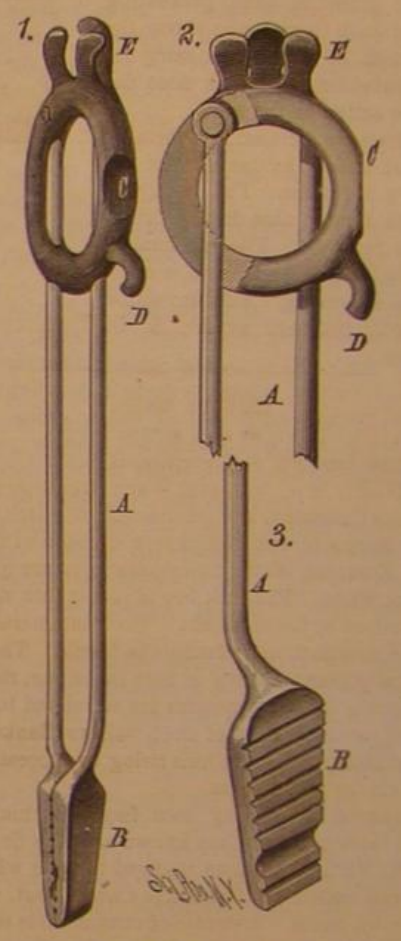
This invention was recently patented, and is being manufactured at No. 243 Water street, by the Portable Fountain Water Closet Company, M. J. B. McQuillin, manager. The post-office address of the company is Box 2279, New York city.

STEAMBOATS FOR SOUTH AMERICAN RIVERS.

Messrs. Yarrow & Co., Poplar, the well known builders of swift torpedo boats, have been recently building two shallow draught stern-wheel steamers, intended for the conveyance of the mails on the river Magdalena, for the Government of the United States of Colombia. These vessels are put together temporarily in the yard at Poplar, and are then taken to pieces and shipped out to their destination. Each vessel is 130 feet long, has 28 feet breadth of beam, and draws 16 inches of water when without cargo and having the steam up, but 26 inches with 90 tons of cargo aboard. The hull is built of steel varying from three-sixteenths inch to one-fourth inch in thickness. It is divided into eighteen water-tight compartments, so as to localize any damage through being penetrated by rocks or snags All the forward part of the vessel below water is treble riveted, as an extra precaution. The boiler, which is of the locomotive type, is placed on the main deck forward, and the engines on the main deck aft, and thus easily accessible. To obtain the greatest economy of fuel the engines are made on the compound surface condensing system, and for the sake of lightness all the working parts are of steel. They are probably the first compound engines ever fitted to stern-wheel steamers. The cylinders lie one at each side of the vessel, and work direct with a connecting rod on cranks at each end of the axle of the wheel. They are expected to develop 350 to 400 horse power, and have some peculiar arrangements to adapt them for the service. The vessels have what may be termed spoon bows; the sterns retain their full breadth, rounding up gradually from the flat bottom to above the water line, and thence upward square. There are three rudders at the stern before the wheels, the center one being a balanced rudder and the other two of ordinary form, the shaft or rudder head extending up from the center one, and the side rudders moving parallel to the middle rudder by means of a connecting link. In the bow, before the boiler, there is fitted a steam capstan for heaving or working the vessel, if necessary, past a rapid. Alongside the boiler, in connection with the fan engine, is to be fitted a circular saw for cutting up the wood fuel. A speed of between fifteen and sixteen miles an hour, at least, on a continuous run, is anticipated from these boats. This, considering the extremely light draught of water, will be a very remarkable result.

IMPROVED TONGS.

The engraving shows an improved tongs designed expressly for household use, and containing several useful implements in one. A ring, forming the head of the tongs, receives the fixed and the movable leg, and has three projections, E, at the top forming a plate lifter, a hook, D, for lifting stove covers and pots and kettles, and a flat roughened, C, forming a hammer face. The jaws of the tongs



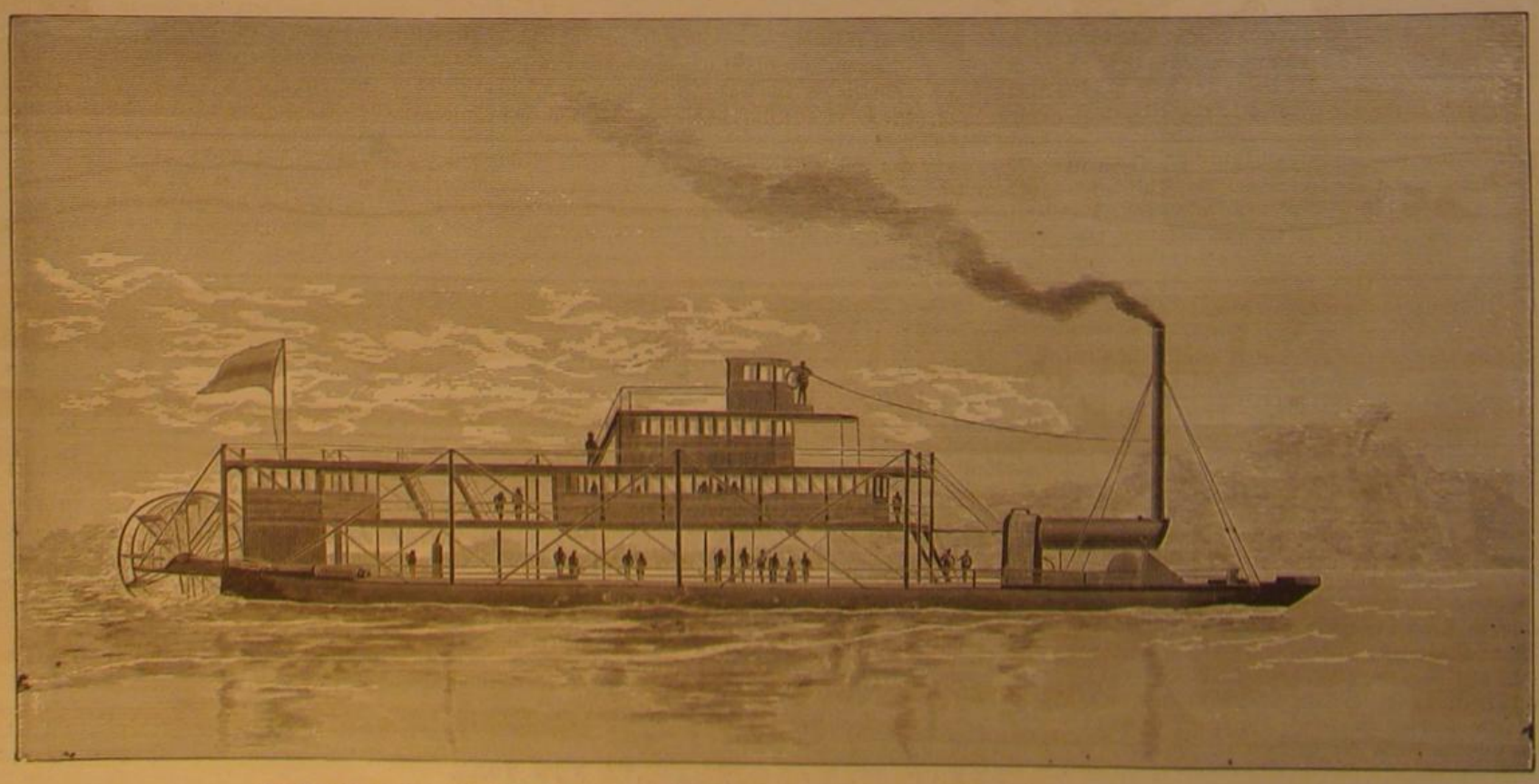
BOARDMAN'S TONGS.

are made angular and oblong in form, so that either of them may be used as a stove cover lifter.

This invention was recently patented by Mr. I. R. L. Boardman, of Snedekerville, Pa.

Prolongation of Life.

Some years ago the French Ministry addressed a circular to all the prefects, desiring them to institute inquiries as to the conditions which appeared peculiarly to favor longevity



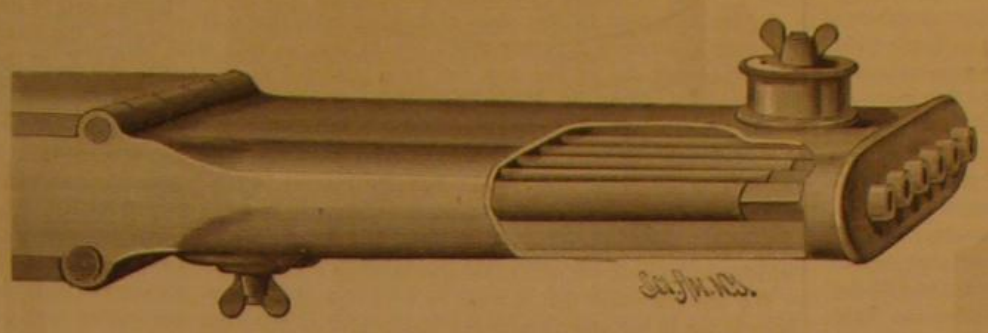
STERN-WHEEL STEAMER OF STEEL FOR RIVER MAGDALENA SOUTH AMERICA.

in their several district and the replies are said to have almost unanimously indicated as the leading elements or influences great sobriety, regular labor and usually in the open air, daily exercise short of fatigue, early hours, a comparatively well-to-do life, calmness of mind in meeting troubles, moderate intellectual powers, and a family life. The beneficial influence of marriage on the duration of life is universally admitted, and remarriage does not seem to be unfavorable. The prefects also indicate heredity as a frequent cause, and the influence of climate is likewise admitted; this latter, however, is separable with difficulty from other causes which may be operating simultaneously; but if all things were otherwise equal, it would seem that southern are less favorable to longevity than northern climates.

IMPROVEMENT IN MACHINE GUNS.

In machine guns the heating of the barrels has limited the number of charges that could be rapidly fired before they become too hot for use, so that after a period of rapid firing the gun would become dangerous if not allowed to cool. The engraving shows a device for keeping the barrels cool by surrounding them with water under atmospheric pressure, thus preventing the temperature from rising above the boiling point of water. A temperature not exceeding 212° Fah. does not impair the action of the gun.

The barrels are inclosed in a metallic water-tight casing having a vent for the escape of steam. The casing is filled from time to time during firing, as may be required. The mechanism for rapidly loading and firing is omitted in the engraving. This invention was recently patented by Mr. E. G. Parkhurst, of Hartford, Conn.



PARKHURST'S MACHINE GUN.

HOWE'S CAVE.

BY H. C. HOVEY.

The most massive and prominent rocks in Schoharie County, N. Y., are, first, the Water limestones, then the Pentamerus limestone, and above that the Delthyris shale. These all belong to the Helderberg division of the Silurian system. From the Water limestones immense quantities of cement are made. The rock lies in rather thin strata, and is easily acted on by the elements. The Pentamerus limestone is firm and compact, and abounds in fossils. The Delthyris shale is really granular gray or blue limestone, rich in coralline remains. These formations are so related to each other as to favor the excavation of deep valleys, flanked by cliffs and mural escarpments, the hills rising by successive terraces to mountainous proportions.

Several caves had already been found in this region, the largest of them being the one known as Ball's Cave, when in May, 1842, Mr. Lester Howe resolved to open what had previously been called the Otsgarage Cavern, but which now bears his own name. A stream of considerable size had long been observed flowing from it by several outlets. This subterranean river was the agent that had made the cavern; but it had afterward obstructed it by *débris*.

Mr. Howe hit on an ingenious plan for utilizing the water. He first loosened the clay, gravel, and broken rocks; then stopping other outlets he flooded the main channel, and thus forced the stream to sweep out its own deposits. This having been effectually done, he reopened the side passages, and made a dry path for 350 yards to Cataract Hall, where the waste water is now chiefly drained away through a transverse crevice. Another drain is at the Whirlpool, 100 yards beyond. These seem formidable terms to be applied to localities not in any way frightful to those visiting the cave in summer; but the guide assured me that during a rainy season the names were appropriate, and that there were times when the whole cavern would be filled, and, as he said, "pour forth a mighty flood."

The pathway beyond the drains crosses and recrosses the rapid, musical stream by stepping stones, until at a point about 1,350 paces from the entrance a double dam has been built, forming a pretty reservoir of extremely pure and limpid water. Iron pipes convey it out to supply numerous dwellings, a large mill, the hotel, and the tank at the railroad station. The supply has never been exhausted.

So much digging and blasting have been done between the entrance and the reservoir as to detract from the primitive wildness of the cave, and it too much resembles an unfinished railway tunnel. Gas, also, has been introduced, thus far with a pleasing effect ordinarily, though far less picturesque than torches and not free from danger. This appeared on the occasion of my first visit, which was in company with a party of 400 excursionists, many of whom caught hold of the pipes overhead to steady themselves along difficult paths. This procedure disturbed the flow of gas. A number of jets were extinguished; and although frequently relighted they could not be kept burning. The air grew heavy with escaping gas, which, being manufactured from gasoline, is very insidious, so that our first indication of peril was the fainting of several persons. I am satisfied that a fatal explosion was averted only by our resolutely shutting off the supply, thus leaving the party in darkness until torches arrived, by the light of which we withdrew to the purer and safer atmosphere above ground.

The next day we examined critically the whole system of lighting up the cave in company with Dr. Lewis, the chemist of the Boston Gas Works, our conclusion being that it is safe enough, if the pipes and jets are not tampered with nor allowed to be eaten through by rust. We would, however, recommend the substitution of electric lights.

It is due to Hon. J. H. Ramsey, the present owner of the cave, and Mr. J. M. Russell, the lessee of the premises, to say that every consideration is shown for the safety and comfort of guests, and that especial facilities were granted to us as explorers.

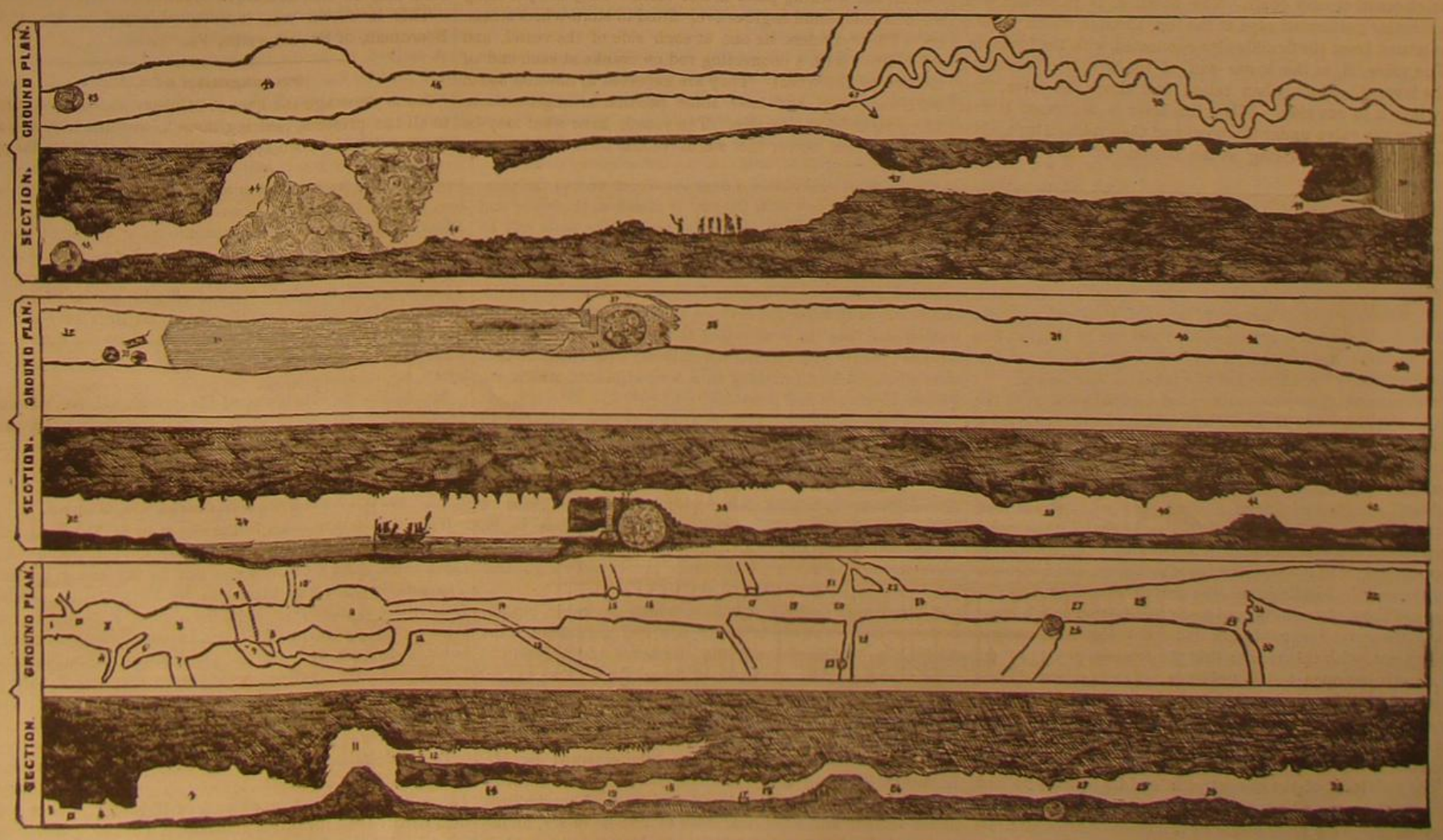
Our guide, Van Dyke, pointed out noteworthy objects, having an incident or legend to tell associated with each. Several romantic people have been married in a room 150 yards within the cave, called for that reason the "Bridal Chamber." It is reached by a long flight of steps, and ends in two or three interesting domes about 40 feet high. The temperature, which was 63° Fah. at the entrance, had here fallen to 50°, and that was found by repeated experiments to be the mean temperature of the cave. The mercury rose in certain places to 52°, and in others fell to 48°, the variation being probably attributable to atmospheric currents. The average is about 6° colder than the temperature of Mammoth Cave, nearly corresponding in each case with the mean temperature of the earth.

The currents of air vary considerably in intensity and direction, owing in a measure to the proximity of outlets and the windings of the cave stream. The air is chilly, and I missed the charming sense of exhilaration noted by every visitor to Mammoth and Wyandot caves, and rightly attributed to the natural oxygenation produced by chemical changes.

An incredible story is told of a young man from Georgia who was cured of pulmonary disease by dwelling three months in a dreary place called the Consumptive's Chamber. Beyond this is a large hall called the Giant's Chapel. Howe's Pillar is a mass of yellow alabaster, 12 feet high, reached by a side passage from Cataract Hall. From a point 1,000 paces within, a stalagmite was removed in 1874 and set up as an ornament in front of the hotel. This fact I have from the guide. Applying my pocket-rule to the new stalagmite that has grown up in its place within six years, it was found to measure 13 inches in thickness and 4½ inches in height. This is a remarkably rapid growth, compared with rates observed in other caverns, and will possibly constrain us to modify our estimates of their antiquity.

In the Haunted Room the imagination may decry spectral forms. But more interesting is the strong draught indicating the nearness of some large apartment, into which an entrance has not yet been effected. The echo in Music Hall prolongs aerial vibrations for only about five seconds. The resonance of the floor, as we tread upon it, again suggests a hollow place underneath. It is asserted in a pamphlet, published fifteen years ago, that there are fractures opening "into a giant cavern below." None were pointed out to us; and if such are known it would be well to explore them, for the present cave floor is far above the natural drainage level.

The reservoir, to which we have already referred, is called the Stygian Lake, and is navigable by a small boat. It is



MAP AND PROFILE OF HOWE'S CAVE, NEW YORK.

about 16 feet deep when full, and is remarkably transparent. Among the numerous stalactites pendent from the roof, the guide singles out the Harp, which emits musical sounds on percussion. The lake is said to be a quarter of a mile long, though its width does not exceed 40 feet at any point. The sheet of water looks finely when illuminated with magnesium or by red fire.

Just beyond the landing place the passage is obstructed by a huge stalagmite reaching from floor to ceiling, and about 30 feet in diameter. Climbing around its upper portion by a narrow pass, we find ourselves on the edge of a pool that is apparently a continuation of the lake. It is surprisingly deep. We sounded to the depth of 35 feet without touching bottom, and took Van Dyke's word for its being 60 feet deep. As the surface of the water is only 45 feet above the level of the hotel, the bottom of this pool must be lower than the mouth of the cave; and the pit it fills may have been the former passageway of the stream to lower tiers of caverns underneath.

The cave now grows wider and with larger chambers as we follow the windings of the rivulet. Uncle Tom's Cabin stands 500 yards from the lake, and is a unique stalagmite of great dimensions, through whose base the flowing water has cut a tunnel by which one can gain the pathway beyond. Next is a hall about 200 feet long and 80 feet high, extending to a gigantic pile of rocky fragments, surmounted by several large stalagmites bearing fanciful names.

Descending from this eminence we find ourselves in a valley only about 10 feet wide, but of remarkable height. Masses of broken stalactites encumber the way, and 60 feet overhead is a projection, 25 feet square, called the Table Rock, accessible by hard climbing. The guide told us that this valley is 1,100 feet below the surface; a fact explained by saying that the cave pierced beneath a lofty hill, a spur of the mountains. We had no means at hand for either verifying or disputing this extraordinary statement; but we were led to doubt it because of the immense quantities of miry clay obstructing several branches that we attempted to explore.

The Winding Way trends to the right from the main cave line, and, together with what it leads to, is the most remarkable portion of the entire cavern. The ground plan of this underground cañon would resemble the peculiar articulation of the suture joining the bones of the skull. The Winding Way is from 2 to 4 feet in width, from 3 to 30 feet in height, and, as measured by us, about 550 feet in length. It is so crooked that it seems as if one changed his direction at every step. The walls are coated with translucent stalagmite equal in beauty to Mexican onyx, which it much resembles. I saw nothing finer in quality, even in Luray Cavern, where the display of Oriental alabaster is so exceedingly diversified and beautiful. The cañon is here and there curiously spanned by stalactitic arches. Having gone about two-thirds of the way through this bewildering passage, we come to a large cavity formed by the dislodgment of a triangular mass of rock which has wholly disappeared under the clay. The Winding Way ends in a circular aperture, through which one can barely crawl, by lying flat on the ground. This, of course, is called the Fat Man's Misery, a name without which the nomenclature of no cave would be complete.

Beyond this place of merry difficulties is the Rotunda, that ends the cave in this direction. There are many excavations in Mammoth Cave of the same nature as the Rotunda, the local name for them being "domes." Some of them are far larger, but none are more symmetrical. They are caused by the rotary action of whirling water freighted with sand and gravel, thus transformed into a powerful cutting engine. The diameter of the Rotunda is 25 feet, and its height was said by the guide to exceed 300 feet, in proof of which he alleged that rockets had been fired upward in it warranted not to explode until they had reached such an elevation. Moreover, it is said, and commonly believed, that no mortal ever saw the apex of the dome. It is a pity to break in upon such pleasant delusions, but regard for the truth compels me to say that by burning common red fire I saw the apex with distinctness; and comparing it with domes in Mammoth Cave, whose height is definitely known, I should say that the Rotunda does not greatly exceed 100 feet in height. But it is, without exaggeration, a very remarkable dome, and it pays the visitor for all the trouble taken in reaching it.

A degree of disappointment must be confessed as to the entire dimensions of Howe's Cave. Some enthusiastic letter writer once said that it was twelve miles long. The report on the geology of New York states that it has been "explored to a distance of seven miles, and seems to extend farther." A clerical friend assured me that it was at least six miles long. It is recorded that one avenue "has never been explored to its full extent, although a party once spent eighteen hours in it, traveling the whole time, and not reaching the end." Finding that the proprietors themselves discredited these statements, and had no objection to my measuring the cave, I accordingly undertook the task, assisted by my son, with this result: that the total combined length of all avenues open to the public is only *one mile and three-quarters*, and that there may be a mile or more additional of by-ways and tortuous crevices never shown to tourists; hence the owners are warranted in their honest advertisement that the entire length is about three miles.

The swiftness of the cave stream, and its liability to sudden overflow, must have prevented the aborigines from making this cavern a place either of residence or sepulture. It may be doubted, indeed, if they knew of its existence. Few animal remains have been found here. Large numbers of bats, however, hibernate in its chambers, clinging in clusters, like swarms of bees. No fish inhabit the lake or the stream, except such as have been put there by the hand of man, and even these forsake these subterranean waters when the spring freshets give them the opportunity to do so.

It should be said, in conclusion, that while Howe's Cave is far surpassed by several caverns in the subcarboniferous limestones of Virginia, Kentucky, and Indiana, it is the largest in this country that has been excavated from the rocks of the Silurian period. Its attractions are very considerable, and some of them are unique and highly remarkable. The cave is well worth visiting, especially as it is so easily reached from New York and the New England States. Its environs are picturesque, and from the piazza of the hotel a wide and beautiful view is commanded of the fertile valley of the Cobles-Kil, beyond which rises the wooded summit of a spur of the Catskills.

RECENT INVENTIONS.

An improvement in that class of ironing table that may be folded compactly together when not in use, so that it may be placed out of the way, has been patented by Mr. William G. Lindsay, of Winnebago, Wis. The invention consists in pivoting or hinging the ironing board to the ends of one of a double pair of hinged or pivoted cross legs, and securing to the under side of the board a ratchet-toothed spring bar, upon which the round of the other pair of cross legs may be placed at any required distance apart, by which means the height of the table may be adjusted.

An improved clasp for albums of all kinds, Bibles, and other books, so constructed that it may be easily closed even should the book be overfilled, has been patented by Mr. Carl Posen, of Offenbach-on-the-Main, Germany.

A water seal cup for waste pipes for refrigerators and for other purposes has been patented by Mr. Sylvester Gray, of Long Island City, N. Y. The invention consists in the combination of a bent wire with the water seal cup and the waste pipe, by which the cup is securely and detachably connected with the waste pipe.

An improved harness buckle has been patented by Mr. Robert D. Whittemore, of Chippewa Falls, Wis. The object of this invention is to provide a buckle which shall tighten with a side pressure upon the trace and hold the trace more securely as the strain upon it increases.

Mr. Samuel S. Gibble, of Mount Joy, Pa., has patented an improved insect trap. The object of this invention is to protect tobacco planters from the pest of the so-called "tobacco worms" (known as the larvæ of several species of *Lepidoptera* of the sphinx family), by capturing the parent moth prior to laying her eggs upon the plants, from which the worm is hatched. The invention consists in providing a wire trap with eyes or rigidly attached loops to serve as a means for supporting it upon a staff or pole, and with a looped pendent wire for suspending the bait beneath the open bottom of the trap.

An improvement in the class of devices constituting an elastic or yielding support for thills or shafts of vehicles, whereby they are automatically raised and held elevated when the horse is detached, has been patented by Messrs. Allen C. Smith and Henry W. King, of Canaan, N. Y. In this position the thills are less liable to be broken or otherwise injured, besides occupying less of the available floor space in the carriage house, and likewise facilitating the reattachment of the horse.

An improved lock for holding reels to fishing rods, which is simple and effective, has been patented by Mr. Henry Prichard, of New York city. The invention consists of a sleeve surrounding the fishing rod, and provided with a notched internal shoulder at its upper edge, which engages with one of a series of studs on the metal casing of the rod. If the sleeve is passed down over the upper end of the plate or strip of metal to which the reel is attached, the lower end of which is passed into a suitable socket, the plate can be firmly locked in the desired position by turning the sleeve.

Mr. Henry O. Koschwitz, of Brooklyn, E. D., N. Y., has patented a method of making buttons and similar articles, consisting in turning the articles in a lathe first in one direction and then in a direction at right angles to the first, and then splitting or cutting the cylinder with rounded ends thus obtained longitudinally into several pieces, which are ground or planed and polished.

Mr. Henri B Burin, of New York city, has patented an improved velocipede, which is so constructed that it may be used upon land and water with equal facility.

Mr. Thomas Leach, of Taunton, Mass., has patented an improvement in baking dishes applicable to all kinds of analogous covered dishes, such as pickle casters, jewel cases, sugar or butter dishes, etc. The dish has novel means for maintaining the cover of the dish in suspended position above the receptacle.

An improved draught equalizer which is simple, strong, and endurable, and can be easily adjusted according to the strength of the animals and the resistance of the load, has been patented by Mr. Franklin H. Standefer, of Fort Payne, Ala. It consists in a doubletree provided with a vertical longitudinal slot, and made adjustable lengthwise on the doubletree bolt by means of a screw.

An improvement in gloves has been patented by Mr. Remus D. Burr, of Kingsborough, N. Y. The invention consists in extending the palm of a glove to form the little finger, thumb, and front and sides of middle finger, an obtuse angled cut being made from the base of the middle finger to the opening of the thumb.

Mr. Francis M. Cummings, of Porterville, N. Y., has patented an improved cheese curd sifter and picker, made so as to sift out the fine curd and pick the coarser or lumpy curd into pieces, reducing the curd to the desired fineness to receive the salt evenly with very little injury to the curd and loss of "white whey."

Mr. John Menahan, of New York city, has patented a pocketbook fastening, which is so constructed as to hold the pocketbook securely closed. It consists in a plate having one or more holes to receive the fastening pin and flanges upon its side edges to receive a sliding plate having one or more holes to receive the fastening pin, and slots between its holes to receive the neck of the fastening pin.

An improved hinge for folding bedsteads has been patented by Mr. Herman A. J. Rieckert, of New York city. This invention relates to hinges for folding bedsteads wherein the bed is fitted for being turned or closed into a stand or cabinet. The object is to furnish a hinge which will permit ready removal of the bed from the stand without the necessity of unscrewing the hinge; and this invention consists in a hinge having its leaves formed separate, one being made with the hinge pin as part of the leaf, and the other leaf made with a semicircular recess for the pin.

An adjuster for the slats of window and door blinds, so constructed that the slats can be adjusted into any desired position, and will be securely held in place, has been patented by Mr. John H. Monk, of Brooklyn, E. D., N. Y.

An improved apparatus or sweat house for curing and sweating tobacco to dark colors without developing any unpleasant or empyreumatic odors, which is unavoidable when the curing and sweating are done in the ordinary manner, has been patented by Mr. Charles S. Philips, of Brooklyn, N. Y.

Messrs. William W. Stratton and Adam Steuerwald, of Columbus, Ohio, have patented an improved cornice for curtains and lambrequins, which can be adjusted to suit any desired opening or space, such as a window, door, niche, and the like.

A labor-saving and effective process and apparatus for simultaneously softening and stretching hides and leather, has been patented by Mr. William Coupe, of South Attleborough, Mass. The invention consists in the application of revolving pin blocks to the surfaces of hides and leather in such a manner that the whole surface of the hide or leather is pressed or acted upon by the pins, and thereby stretched and softened.

An improved bag tie has been patented by Mr. Lewis A. Fish, of Faribault, Minn. The invention consists of a double-eyed double hook, whose hooked end is formed by bending the end up at right angles to the shank, then along the shank of the hook and parallel therewith, then upward again at right angles, and finally back on itself and parallel with the shank, and whose eyes are formed on the other end of the shank by loops extending laterally on either side.

Mr. George Oliver, of the City Road, County of Middlesex, England, has patented a novel apparatus for use in theatrical and other performances, for suddenly raising a performer to a considerable height from the stage, the apparatus consisting, mainly, of an assemblage of vertical springs arranged overhead, the performer being connected thereto by a fine wire or rope. The object of this invention is to render the apparatus available for use in theaters or other buildings where there is not sufficient height to admit of the springs being placed in a vertical position.

A method of producing distinct and artistic patterns on pearl buttons has been patented by Mr. Charles L. Woodbridge, of Brooklyn, N. Y. The invention consists in first painting or sizing on the surface of the button, with some substance not soluble in a nitrate of silver solution, the pattern that is to be produced; then a solution of nitrate of silver is applied with a brush to the whole surface of the button, and the button then exposed to the light. The actinic effect of the light soon changes the color of the nitrate of silver either to a light brown or a darker color, according to the duration of the exposure and strength of the solution. Then the paint or size is washed off with spirits of turpentine or other resolvent, and the design is thus left clear and distinct in the natural color of the button on the face of the button, after which the design may be further wrought out by engraving and gilding.

Mr. Lucius S. Edleblute, of Cincinnati, O., has patented an improvement in the class of thill couplings or shackles in which the thill irons are adapted to be detached from the axle clips when raised to a vertical position.

How Church Tower Clocks are Wound.

The oldest tower clock in the city is in St. Paul's steeple. It was made in 1778 by John Thwait, of London. The clock in St. John's Church was put in the tower in 1812. The Trinity clock was placed in its lofty station, 200 feet from the pavement, in 1846, by James Rogers. In dry weather this clock runs well; but in damp, chilly weather it sometimes stops, owing to the precipitation of moisture on the wheels. Originally two men were required to wind it, each of the three 1,500 pound weights having to be lifted over 50 feet. Some time ago the winding gear was changed so that one man can now wind it.

Describing the operation of winding, the clock-keeper said, the other day: "The crank is about 20 inches long, and when I turn it around I make a sweep of 30 inches. It's a good deal harder than turning a grindstone, but the machine has a ratchet, so that I can stop and rest when I want to. The crank has to be turned 750 times to turn the barrel 21 times.

Around the barrel is wound the wire rope that holds the 1,5 0 pound weight. The weight is simply a box with pieces of iron in it. That is very old-fashioned. Now we have iron weights so moulded that they can be added to or subtracted from, and the weight can be graded to a nicety. A new wire rope was put to the chimes weight the other day. The rope is what is called tiller rope, and is 280 feet long and three-quarters of an inch thick. It takes me an hour and a half to wind up the clock."

St. Paul's clock has a single back gear and two weights of 1,000 pounds each. It takes three-quarters of an hour to wind it. St. John's clock is wound in less than an hour; while the modern clock of St. George's, in charge of the same keeper, is wound in fifteen minutes.

THE FACE IN HEALTH AND DISEASE.

Among the earlier authors who were ignorant of many of the present methods of determining the condition, size, and position of the bodily organs (since the art of auscultation and percussion is a growth of later date), the study of the human countenance formed a very important part of the preparatory drill. The followers of Hippocrates and Galen were rendered perfect in their perceptive faculties. The former gave, in his masterly work, descriptions of disease which are still considered classic; while the latter, in his essays on the "Temperaments," is equally careful to note the most trivial alteration either of the face or of the posture. In modern times the diagnostic value of general physiognomy has been studied by De Salle, Jadelot, Siebert, Lavater, Laycock, Corfe, and others. Those who question the utility of this much neglected department of science would do well to read Darwin's great work on the expression of the emotions in animals, and the contributions of Connelly upon the typical shades of expression peculiar to the insane. With a view of systematizing and arranging the collected investigations of the above named authors, and bring within the compass of a single article such practical information as the anatomy of the face may afford the practitioner, Dr. Ambrose L. Ranney contributes an illustrated paper on the subject to the December number of the New York *Medical Journal*. The physiognomy of the sick presents innumerable shades of expression, and these may not only be the direct result of the influence of the ever-varying passions upon the muscles of the face, as is the case in health, but they may also be classed as morbid phenomena, each of which possesses some special significance. The diagnostic value of *facial lines and wrinkles* has had its share of support from many authors. These wrinkles may be classified in six groups:

(1) *The transverse rugæ*, situated on the forehead, and thought to be expressive of an extreme amount of pain arising from causes outside of the cavities of the body. (2) *The oculo-frontal rugæ*, extending vertically from the forehead to the root of the nose, and thought to express distress, anxiety, anguish, and excessive pain from some *internal cause*. It is said that when the first-named rugæ meet the latter abruptly during the course of an acute disease, some serious lesion of the brain, or its coverings, is developing. (3) *The linea oculo-zygomatica*, extending from the inner angle of the eye downward and outward, passing across the face below the malar bone. This, in children, is said to indicate a cerebral or nervous affection; and, in adults, some disorder of the genitalia. (4) The *linea nasalis*, extending in a curved line downward from the sides of the nose. This line is said to be strongly marked in phthisis and in atrophy. Its upper half is thought to be a reliable indication, if prominent, of intestinal disease; the lower half is supposed to indicate the existence of disease affecting the stomach. When it appears conjointly with the foregoing (No. 3), it is claimed that it may be regarded as a positive indication of worms in children, provided a peculiar fixed condition of the eye exists and a pallor of the face is present. (5) *The linea labialis*, extending downward from the angle of the mouth till it becomes lost in the lower part of the face. This is usually developed in connection with those diseases which render breathing laborious or painful, and is commoner in children than adults as a valuable diagnostic sign. (6) *The linea collateralis nasi*, extending from the nose downward to the chin in a semicircular direction. It is thought to be a reliable guide to diseases of the thoracic and abdominal viscera.

The nostrils are of practical interest from a medical standpoint. They dilate forcibly and rapidly in difficult respiration, when produced by disease; and itching of the nostril is regarded by many authors as a valuable diagnostic sign of intestinal worms. Marked elevation of the nostril is regarded by some authorities as an indicator of pain within the cavity of the thorax. The eye also affords many diagnostic signs. An irregularity of the pupils of the two eyes indicates, as a rule, pressure upon nerve centers or upon the optic nerve itself. In adynamic fevers the eyes are heavy and extremely sluggish, and are, as a rule, partially covered by the drooping eyelid; while in certain forms of mania they are seldom motionless. In "Bell's paralysis," due to failure of the facial nerve, the eyelids stand wide open and cannot be voluntarily closed, since the orbicularis palpebrarum muscle is paralyzed. In cardiac hypertrophy an unusual brilliancy of the eye is perceived. In scarlet fever a peculiar glistening stare exists, which is in marked contrast with the liquid, tender, and watery eye of measles. Many diseases of the eye itself tend to greatly alter the normal expression of the face, and prominent among these may be noted cataract, glaucoma, cancer, iritis, etc. Abnormalities of the pupils may afford the practitioner material aid in diagnosis. The pupils are found to be dilated during attacks of dyspnœa and after excessive muscular exercise, in the latter stages of anæsthesia, and in cases of poisoning from belladonna and other drugs of similar action.

A contracted state of the pupils exists during alcoholic excitement, in the early stages of anæsthesia from chloroform, and in poisoning by morphia and other preparations of opium, chloral, and some other drugs. Certain signs may also be had from the lips and mouth. In sickness, if the angle of the mouth be depressed, pain and languor may be read; and when the corrugator supercilii muscle cooperates with the depressor muscles of the mouth, acute suffering is proclaimed. Extreme pallor of the lips is seen in excessive hemorrhage, in purpura, in chlorosis, etc.; deep lividity denotes a defective oxygenation of the blood, and occurs in diseases of the lungs, heart, and larynx; while pale lividity occurs in cases where the circulation of the surface is languid or imperfect. In painful affections of the abdominal organs the upper lip is usually raised and stretched over the gums or teeth, so as to give a diagnostic expression to the countenance, which is considered by some as of great value. Many of the specific forms of disease have their own special physiognomy, which have a value to the diagnostician, but a further reference to which can scarcely be made in a short article like the present. It is to be hoped, however, that these facts from Dr. Ranney's paper, fragmentary as they necessarily are, may tend to awaken in the profession a renewed interest in a subject which is rapidly being lost sight of, and the value of which is often ignored. It is not to be expected that sight alone can guide the medical attendant to unerring diagnosis, but that it may prove of the greatest value as *an aid*, the facts adduced seem to render undisputed.

THE CHICAGO POLICE ALARM SYSTEM.

Mention has been made in this paper of the system of telegraphic alarms recently adopted in Chicago for police signaling. Sixty days' trial of the system in the 12th Street District has convinced the city authorities of the advantages of the system, and it is now proposed to extend it to the West Lake Street District, covering an area of over four square miles.

The public alarm-houses, as described by the city Chief of Police, are built of wood, and just large enough to admit a man. They are placed upon the sidewalk, as near to street corners as practicable, and securely fastened either to telegraph poles or corner stores. The keys to such houses are uniform; they are furnished to respectable citizens upon application at the station, and a record kept of the names of key holders. A mechanical alarm to register the location of the complaint is inclosed in a small box attached to the side of the house, which box also incloses a telephone for the use of the officer traveling that particular post, and which places the officer in direct communication with his commander at the station. The citizen who possesses a key can, by pulling down a lever which protrudes through a slit outside the box, procure the attendance of three policemen and a horse and wagon in from one to four minutes after entering the alarm-house. The wagon carries a stretcher, blankets, shackles, handcuffs, etc., and can be used either as an ambulance or conveyance for prisoners. The alarm-houses are furnished with patent locks, which, after opening, retain the key until an officer arrives with a master key, which he inserts in the reverse side of the lock and releases the original; this precaution is taken to prevent false alarms, and to keep the complainant at the alarm-house until the officers arrive to hear the complaint and apply the remedy. A large bell will be procured and erected upon each station, and at a given signal each officer in the district will be required to report immediately at the alarm-house upon his post, so that if any serious crime be committed in the district the officer in command at the station can summon each man on post duty, and telephone to his whole command at once, giving information to his men of the nature of the crime committed, and, if known, a description of the criminals, thus putting each patrolman on the alert to arrest the suspected parties.

In addition to these public alarm stations are private boxes combining police and fire alarm calls, which are to be placed in stores, offices, and dwellings at a cost of about $30 each. These boxes are so small that they can be set in a wall, behind a desk, or under a counter, and a noiseless alarm given, which will not disturb the thief or swindler until the officers arrive to make the arrest.

Fire-alarms can be given in the same manner, and registered at the headquarters of the Fire Department in one second after the alarm is turned in.

A Georgia Ice Factory.

A correspondent of the Hartford *Times* describes as follows the factory of the Georgia Ice Company at Atlanta:

On the ground floor is a boiler 50 feet long and 4½ feet in diameter, containing 150 feet of 3½ inch pipe. The boiler is kept filled with aqua ammonia, which is separated by the steam heat into ammonia gas and water. The gas, leaving the water in the boiler, forces its way through a 6 inch pipe outside the building to the roof, three stories up, where it passes into 15,000 feet of coiled pipes, in which it is converted into liquid by cold water thrown over it in fountain jets. This liquid passes into 15,000 feet of three-quarter inch pipe, arranged in vertical sections 80 feet high and 3 feet apart, and its sudden liberation into these pipes turns the liquid pure ammonia into vapor, and the sudden expansion makes the pipes intensely cold. Now, above these hundreds of vertical pipes are innumerable little fountain jets throwing spray all over the pipes, the spray freezing gradually, forming an immense icicle of pure ice around each pipe. The gas next goes into 15,000 feet of absorbing pipe, and, being cooled by water running on the pipes, it is met by water forced into the pipes, and thus converted back into aqua ammonia, which goes into the big boiler, and is not used over again. There is no waste, the same ammonia being used and reabsorbed any number of times. The water used for the spray is drawn from a well 75 feet deep, on the premises, and the large blocks of ice (which are loosened from the pipes by a little hot steam) come out pure and clear, and entirely free from any odor or objectionable taste.

After the pipes have been stripped, about five weeks are required for a new lot of the requisite thickness to form. But, of course, the pipes are never all stripped at the same time, the ice towers being in all stages of formation. The factory has a capacity of 35 tons per day, but 20 tons keep pace with the demand, and it isn't stored, but cut every day as it is delivered, and it sells at from $10 to $12 per ton.

ENGINEERING INVENTIONS.

Messrs. T. A. Trudelle and Eusebe Maheux, of Quebec, Canada, has patented an improved car coupling, which consists of a spring-actuated draw head and peculiarly adjusted levers operating a coupling pin, in combination with a spring-actuated draw bar, that serves to hold the coupling pin up when the cars are uncoupled.

Mr. Benjamin F. Walker, of Derrick City, Pa., has patented an improved clasp-packer for well-tubing joints to prevent the waste of oil when removing tubing from oil wells. The device is made in two semi-cylindical parts, hinged to each other at one side edge and fastened at the other side edges with a hook and pin, and provided with packing at its ends and side edges to adapt it to be clasped around the tubing at its joint, and having a side opening and hose to carry the oil to a receiver.

An improved engineer's level-rod has been patented by Mr. Michael L. Lynch, of Cameron, Texas. This invention relates to the class known as "self-reading level rods," and is distinguished from others by the peculiar manner of marking the scale upon the face of the rod, whereby the readings of fractions of a foot may be readily made without the use of a sliding target.

Improvements in steam generators, designed more particularly for generating steam for heating buildings, but applicable generally to the generation of steam for power purposes or other uses, has been patented by Mr. Nelson Coombs, of Titusville, Pa.

Mr. William J. French, of Carencro, La., has patented an improved device for securing nuts on railroad, bridge, and other bolts. The invention consists of a recessed segmental washer, in combination with a segmental forked or pronged clip locking in with said washer.

Barbed Wire Fence Patents.

In a recent issue the Chicago *Inter-Ocean* reports an important decision by Judges Drummond and Blodgett, of the United States Circuit Court for the Northern District of Illinois, with regard to the right to manufacture barbed fence wire. Fourteen suits were decided, all in favor of the complainants, the Washburn & Moen Manufacturing Company, of Worcester, Mass., and Isaac L. Elwood, of De Kalb, Ill., who are jointly interested in the patents involved, and are also largely engaged in the manufacture and sale of barbed fence wire. The decision is that all persons who have been manufacturing and selling the infringing barbed wire are liable for back damages. It is stated that Judge Lowell, of the United States Circuit Court of the Massachusetts District, had advised the complainants, who had several suits pending in his circuit, to await the decision of Judges Drummond and Blodgett. It is also reported that numerous suits pending in Iowa, Missouri, and other States have been suspended for the same reason, but will now be proceeded with. By this decision the complainants are shown to be the only parties who have the right to manufacture and sell barbed fence wire.

Uselessness of Chian Turpentine in Cancer.

Dr. Henry Morris, after giving Chian turpentine a pretty thorough trial in several cases of cancer, the details of which he gives in the *Lancet*, arrives at the conclusion that this recently vaunted remedy is utterly valueless in this dread disease. He says: "I am not able to report that there is a single symptom over which the drug seems to exercise even frequently, not to say constantly, an influence. It cannot be relied upon to assuage pain, to diminish or alter the character of the discharges, to check hemorrhage, or promote the destruction of the growth by ulceration or sloughing. In the few cases in which the patient at first thought she was benefited, the impression was due to that 'clutching at straws' tendency, that is so often observed in persons suffering from lingering and incurable disease, and to her being encouraged to think that she was taking a new and certain cure. Rest, regulation of diet, attention to the bowels, an anodyne at night, and the extra local cleanliness which follows from the use of injections and lotions, will of themselves, and without any internally administered drug, give temporary ease and improvement."

A MYSTERIOUS EXPLOSION AND ITS CAUSES.

BY JOSHUA ROSE, M.E.

A singular explosion recently occurred at John Ellet's kindling-wood manufactory, at 529 West 55th street, in this city. The bare facts are as follows: The boiler was licensed to carry 100 lb. of steam, but was usually worked at from 35 to 50; at the time of the explosion there was a pressure of 50 lb. A circular-saw bench stands about 16 feet from the boiler; the saw overhung the bench at one end of the spindle, while a fly wheel overhung it at the other end—the plane of rotation of this wheel being about in a line with the center of the vertical boiler. There was a pile of wood inside the saw bench, which was about 18 feet distant from the boiler, and the operator was standing at this pile of wood and between the saw and the fly wheel, facing the boiler, when a sudden explosion occurred, and a heavy volume of steam shot in a straight line upon the operator, very severely scalding him. He fell behind the pile of wood, whose partial protection probably saved his life, though at the time of this writing he lies in a very precarious condition. The boiler belched forth its steam in a solid column until emptied, and it was then found that the circular saw, with its spindle and the fly wheel, had disappeared, while there was a hole in the boiler measuring about 3 inches by 6 or 7. A short piece of the saw spindle was found, and on it the part of the saw shown in our engravings at Fig. 2. Other pieces were found embedded in the timbers of the building, where a piece still lies entirely out of sight. A piece of the rim of the fly wheel was found beside the hole in the boiler, which is shown in Fig. 1. Another piece was found about 500 feet distant, in Tenth avenue. But not more than one quarter of the wheel has been found at all, the remainder having totally disappeared. One piece in its flight tore a groove about 2½ inches wide in a beam and passed through the roof. Of the circular saw about three quarters have been found, the remainder being missing. The spindle tore itself out of the bearing caps and was found in the yard minus all the fly wheel except the hub, and minus the circular saw and the overhanging piece of shaft.

The spindle was 2¼ inches diameter, of wrought iron, and about 4 feet long. The saw was about 26 inches in diameter, and, contrary to the usual practice, was slightly thicker (say, one thirty-second of an inch) at the eye than at the rim. The fly wheel was about 30 inches in diameter, being a plate wheel with a web three-eighths inch thick.

A great many mechanics, as well as some of the authorities, have been investigating the matter to discover the cause of the explosion, and some of the latter are still investigating it for their private information. The general opinion prevails that all the materials were of good quality and sound, and that the saw flew first, and the spindle and fly wheel simultaneously, though at first it was supposed that the boiler was the first thing to give way. But there is an atmosphere of mystery surrounding the affair, and nobody seems to have any distinct theory of the order in which the casualties occurred, and no theory whatever as to the causes leading to them. Pieces of the fragments have been preserved as curiosities, and this possibly accounts for some of the missing parts.

The man in charge afforded me every facility to investigate in my own way, stating that the proprietor, Mr. Ellet, was one who spared no expense to have his machinery kept in the best order; that the establishment was nearly a new one, having run about three months, and that he, as much as anybody, was anxious for a solution of the mystery. The saw itself had been running about two months, but the spindle and fly wheel, or, more correctly, balance wheel, was old, having been running nobody knew how long in a circular saw mill in another establishment.

The fragments of the saw were first examined. The metal appeared close grained and tough, with no signs of any thing but new clean fractures. Various pieces were tested by being bent back and forth with a hammer. It appeared sound and tough; indeed, of excellent quality, each piece tested having a clear ring. A file test showed it of even temper, and if anything, rather soft than otherwise, which added to its strength. Those who examined it state that it was quite cool when picked up after the accident, and that there were no signs of heating either in it or the spindle. The fractured piece of boiler had been preserved as a curiosity by one of the workmen, but it was submitted for inspection, and is shown in Fig. 1. It was five-sixteenths of an inch thick, of good sound fibrous iron, very free from scale, even the line made by the calking tool being clean and clear. The rivet holes were clear and as round as could be expected. It had clearly been fairly burst open by a flying fragment, there being on opposite sides of the rent two bright places as clearly cut as though cut by a milling tool: it was bulged out, or rather inward, an inch or two from the force of the blow. Failing to find any cause for the accident in either the boiler or the saw, the saw spindle was next examined at the blacksmith and machine shop of Messrs. Potter & Macdougall, who were making a new spindle of steel. The piece that flew off with the saw showed a clean, short fracture, with a fine dark line running across it, ending in a small flaw. The shortness of the fracture and absence of any signs of fiber in the iron led to a suspicion that the iron was crystallized, an opinion with which Mr. Potter concurred; but the other side of the fracture (on the main body of the spindle) showed the fine dark line a part of the way only, and no signs of any flaw, while the circumferential surfaces of both pieces appeared quite sound. With a view to test the soundness of the spindle, I had the spindle made red hot and cold water poured upon its end, and as a result there appeared a crack whose outlines became apparent in a black line, caused by the rapid cooling of the crack edges on one side; this darkness developed a complete cavity about half an inch deep, this cavity corresponding in location to the flaw at the end of the black line in the other half of the fracture shown in Fig. 3. To test if this crack ran along the shaft, and to see the difference in the grain of the iron, a piece was broken off the spindle end, the fracture being shown in Fig. 4, the crack having disappeared. The remaining end of the shaft was then annealed to see how far such annealing would remove the granulation and restore the fibrous structure of the iron, and the fracture of a piece broken off after the annealing is shown in Fig. 5. The remaining end of the shaft was then forged down square, the fracture being shown in Fig. 6. Here the grain shows a close, clean, dull-gray fiber, and an entire absence of the granular crystals. It will be noted that the original fracture is the shortest and the most granular, and that the iron became more fibrous after the annealing and after the forging, the latter having totally altered the structure. Referring to the piece broken off before the annealing, its fracture shows a far superior one to that occurring with the explosion, but more granulation than the annealed piece, and in this connection it may be stated that Mr. Potter, of the firm named, informed me that to remove the crystallization Messrs. Caird & Co., the eminent engineers of Greenock, Scotland, made it an annual practice to take down, during the Christmas holidays, the chains from all their heavy lifting cranes for the purpose of annealing them—a practice, indeed, that is followed in many of the large engineering establishments in England.

The method of effecting the fractures was as follows: Each piece was nicked around with a cold chisel; the piece was then put under the same steam hammer, the weight of the hammer holding the piece, and the side face of the hammer being even with the nick, the protruding end being broken off by sledge hammer blows. The chisel nicks are of equal depths, measuring 1⅝ inch at the bottom of the nick for the two pieces, Figs. 4 and 5. But it was found that the annealed piece took more blows and more forcible ones to break it, as is shown by the hammer marks in Figs. 7 and 8. The flattened places are those made by the sledge hammer to produce the fractures, those in Fig. 7 evidencing how much stronger the annealed was than the unannealed piece.

The heights of the various fractures are shown as evidencing that in proportion as the location of the fracture was receded from, and as the metal was worked (either by annealing or forging), the metal improved. It is probable that the crystallization of the metal proceeded more rapidly at the line of original fracture because of the presence of the flaws, which would induce increased vibration at that cross section when in rapid motion.

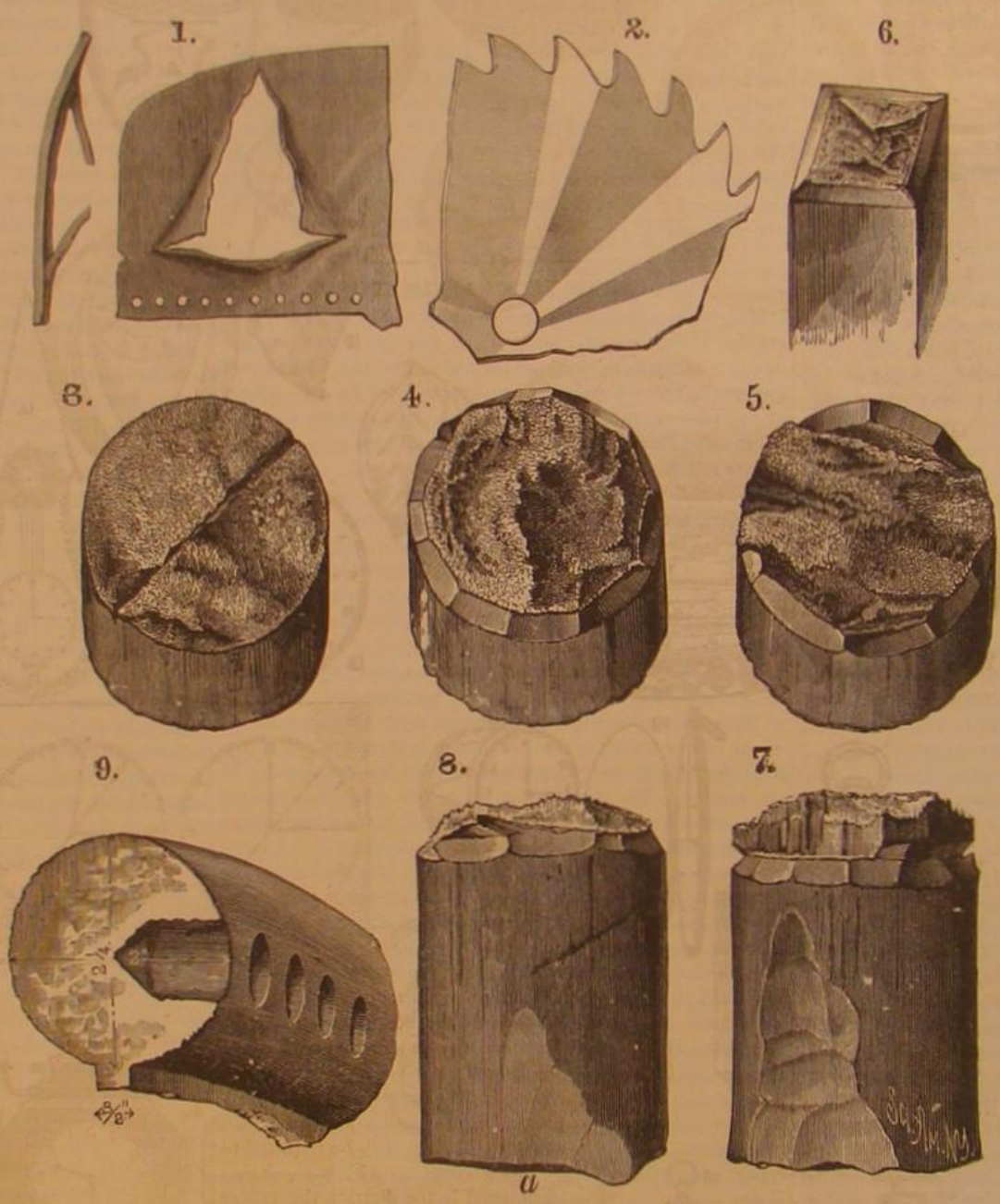
a, in Fig. 8, is a side view of the original fracture to show its shortness.

It is suggested that some of our technical mechanical schools test these pieces of spindle for torsional strength, to see if the order of strength agrees with the apparent order of crystallization and the effect of the reforging. The conclusion appears unquestionable that the shaft broke first, for the following reasons: Had the saw broke it would have simply left the spindle in its bearings with the fly wheel in place. If the fly wheel broke first, it should have left the spindle all right running in its bearings. But as soon as the spindle broke the saw would revolve eccentrically, generating a force sufficient (at the great speed) to cause the breaking of both the fly wheel and the saw, and account for the spindle tearing from the bearings.

The bursting of the fly wheel is plainly due to the holes drilled in it, and it is unaccountable how any mechanic could commit such a blunder as to drill such holes in such a location; their number, and size (as shown in Fig. 10), preclude the idea that they could have been made to balance the wheel, especially as it appears a well-shaped casting, and was a web or plate wheel. In the only other piece of the wheel rim found there are none of these holes, and the fracture occurs in the center of a hole, all pointing to the same conclusion, namely, an unbalanced wheel whose explosion caused all the damage.

It is only proper here to express thanks to Messrs. Potter & Macdougall for their kindness in placing a blacksmith at my disposal, laying other work aside to test the pieces as described in the interest of science, and refusing compensation for the same.

The diameter of the fly wheel being thirty inches, and its revolutions being 2,000 per minute, its velocity was over 500 miles an hour; but in this connection it may be stated that the diameter was estimated by the attendants, who did not know as to its correctness, there being not enough of the wheel left to ascertain its exact diameter, the piece shown in Fig. 10 being the largest remaining. The iron of the wheel looks close-grained and of good texture, the break being around the web close to the rim and across the rim. That at the center of one of these holes is undoubtedly the original fracture, the other fractures occurring subsequently.



FRACTURES CAUSED BY A MYSTERIOUS EXPLOSION.

OWING to the severe competition of Swiss and German factories the manufacturers of St. Etienne, France, are arranging to substitute gas for coal as a source of power for looms and the like. As there are coal mines in the neighborhood of St. Etienne, it is expected that the gas will be cheap, and that by its use the productive power of the machinery will be increased at least fifty per cent.

CURIOUS TIME MEASURERS.

When clocks passed out of the hands of blacksmiths the inventive faculty was quickly at work among the new school of clockmakers to make portable timekeepers. The idea must have been carried out practically late in the fifteenth century. In a tract printed at Antwerp in 1530, Gemma Frisius writes of small clocks, or watches, as "lately invented." The earliest maker with whose name we are acquainted is Peter Hele, who, about the year 1490, made watches which (being oval, and also in honor of Hele's native city) were called Nuremberg eggs. These were principally made of steel; they moved without weights, pointed to and struck the hour, and could be carried on the person. Catgut was used in the earlier watches in place of chains; the latter, it would seem, being first attached to such mechanisms in the golden egg or acorn-shaped watches of Hans Johns, of Königsberg. Some of this maker's timekeepers had small wheel-lock pistols to serve as an alarum, an addition that would go far to upset the equable temperament and delicate susceptibilities of a modern chronometer.

Gaspar Visconti, a Milanese poet, alludes to watches in a sonnet written in 1494, so these time measurers must have come into sudden notoriety. The early watches were mostly large and richly chased. There was one such in Sir Ashton Lever's collection, with the date 1541, but by the next year we find a striking watch mounted in a ring, so the makers must quickly have modified the size of the works. Watches in these times were greatly prized, and but rarely found in the possession of any but of royal or noble persons. The makers were busy, however, if not intent upon turning out many, at least in improving the quality of those finished. Dr. Derham describes a watch said to have belonged to King Henry VIII., which only required winding once every seven days, and Anne Boleyn had a similar one. The Emperor Charles V. had a remarkable taste for delicate mechanisms, and his passion for watchmaking was adduced in proof of his insanity by Voltaire.

There is a watch of about this period in the Loan Collection at South Kensington, which is believed to have been worn by Lord Hussey, who was beheaded in 1536. It is in a silver case, with key attached, and is very diminutive. The name of the maker, R. Crayce, is engraved inside. This is the property of Lord Audley. There is another early watch of silver-gilt, and English make, dated 1539, lent to the Museum by Count Edward Stuart d'Albaine.

In Elizabeth's time watches had come into more general use, though it does not seem to have been an uncommon thing to borrow a timekeeper. The Earl of Leicester, Elizabeth's master of the horse, presented the Queen with "a rounde clocke [*i. e.*, watch] fullie garnished with diamondes," which was suspended to an armlet. The Virgin Queen seems to have been in luck's way, for, in 1574, Margaret, Countess of Derby, gave her "a white beare of gold and another of pearle, holding a ragged staffe, standing upon a tonne of gold, whearin is a clocke." The "clocke and all" weighed three ounces.

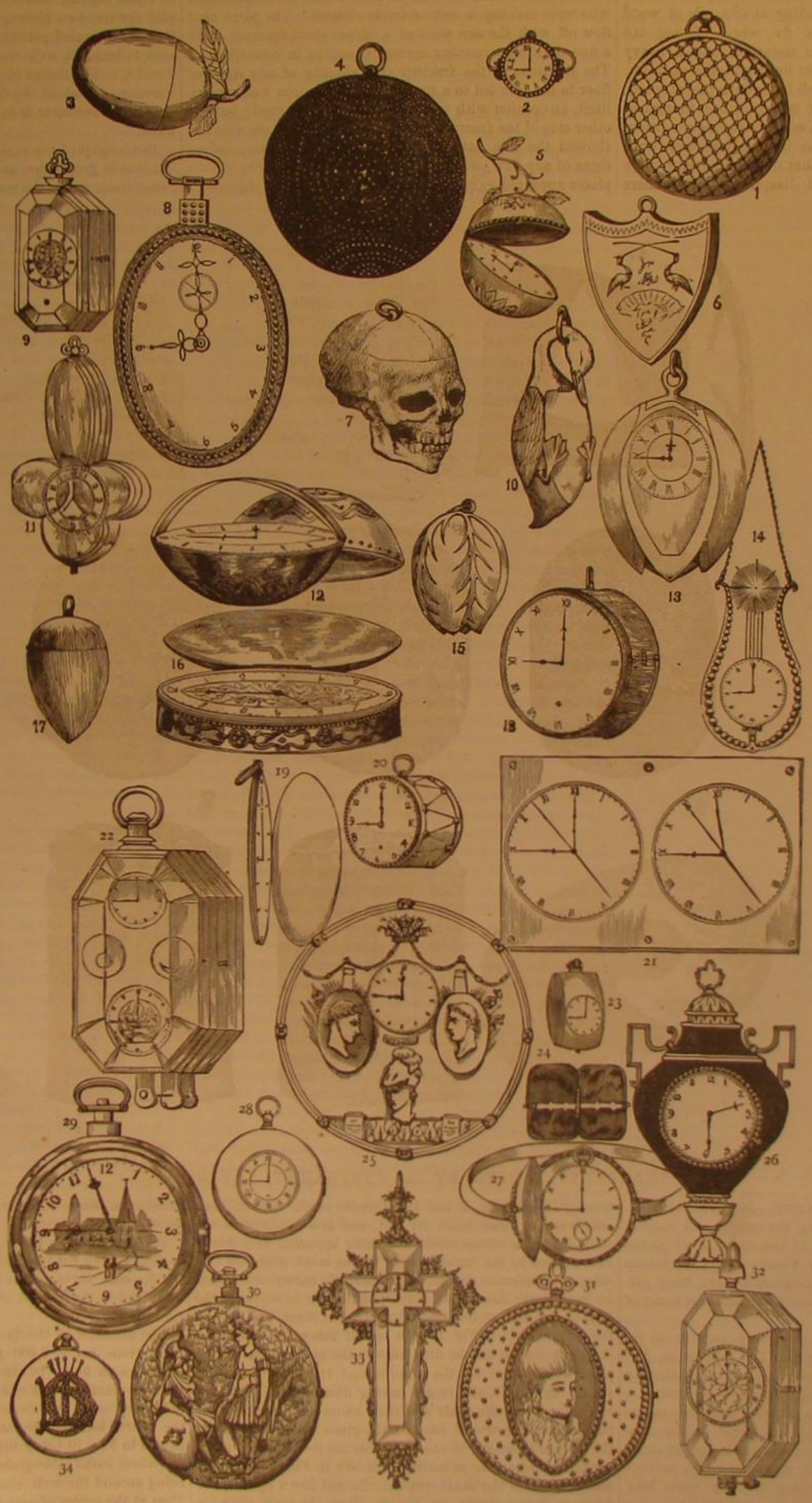
Mary Queen of Scots had several watches of a gruesome and lugubrious character. One was in a crystal case, coffin-shaped; another, which she bequeathed to her maid of honor, Mary Setoun, was in silver-gilt, in shape of a human skull. Upon the forehead was engraven a scythe and hour glass placed between a palace and a cottage, to show the impartiality of death. At the back of the skull was Time destroying all things, and on the top scenes of the Garden of Eden and the Crucifixion. The watch was opened by reversing the skull, placing the upper part in the hollow of the hand, and lifting the hinged jaws. These "memento mori" watches were most likely intended for a "Prie-dieu," or small altar, in a private oratory. At South Kensington is a small silver watch of English make in the form of a skull. Inside is inscribed the maker's name, "Isaac Lenard"—Penard (?)—and in the Fellowes Collection at the British Museum is a similar watch of Swiss manufacture, by J. C. Voulf, about the year 1600. There are other peculiarly-shaped watches of the same period extant. At South Kensington is a silver watch formed like a duck hanging by the neck. It is two and seven-eighths inches in length, and by a German named Henry Ester. One of this maker's watches in the British Museum is tulip shaped, and dated 1600. Another small tulip timekeeper is at South Kensington, with the name, "Henry Grerdon, at ye Exchange, fecit," within. The same collection contains a watch in the form of a cross, with gilt-metal frame, and pieces of crystal in front, back, and sides; and one with a group on the top—a Venus and Cupid, with dog—the watch bearing the maker's initials, "N. K." At the British Museum is a German cruciform dial, presented by A. W. Franks, Esq., made by Melchior Reichol in 1569; also an English watch in the shape of a fritillary flower, by Edward Brysse, date 1580; and a German octagonal watch with date 1550 (*temp.* Edward VI.). The Scottish Society of Antiquaries have a watch of Sir Walter Raleigh's, which belongs to a subsequent period. Watches were no doubt greatly prized, and we hear of one of the useful articles being presented by a Polish nobleman to Erasmus; and in the will of Archbishop Parker, dated 1575, his "staff of Indian cane, with a watch on the top," is bequeathed to the Bishop of Ely.

James wore a finger ring with a watch set in the jewel. One of his timekeepers (extant) is oval, and nearly all brass. The dial is a silver ring one-eighth of an inch wide. The hours are engraved in Roman numerals, and there is a small stud at the base of each, so that the hour could be ascertained by the touch in the dark. Above the dial are figures of Leda and the Swan, and below a cherub's head between two foxes. In this watch catgut is used instead of a chain. The king, writing from Windsor, April 18, 1623, to his "sweete boyes," who were in Spain, sends jewels for the Duke of Buckingham, the prince's companion, to give away; one is "a clocke of goulde, garnisht on the one side with letters of dyamondes, *Dieu et mon droyte;* and on the other side a cross of dyamondes fullie garnisht, with a pendante of dyamondes."

Charles I. had two watches, one of gold and one of silver, placed near a lamp upon a stool at his bedside. On the morning of the unhappy king's execution, while on the way to Whitehall, he gave the silver watch to Sir Thomas Herbert. This is still preserved. It is richly chased, three inches in diameter, and one and a quarter thick.

In the Fellowes Collection at the British Museum is a watch formerly worn by Milton. It is of silver-gilt, and steel faced, the dial covered by a glass. Upon the face is inscribed "Ioanni Miltoni, 1631." It was made by "William Bunting, in Pope's Head Alley."

In the same rich collection are two oval silver watches



CURIOUS TIME MEASURERS.

1. Back of Watch, chased case.—2. Watch in finger ring.—3. Acorn-shaped watch.—4. Shagreen case, ornamented with pique; English, 18th century.—5. Gold, apple-shaped watch; case enriched with seed pearls; date 1760.—6. Gold shield-shaped watch; arabesques in transparent enamel; Swiss, 18th century.—7. Memento mori watch, by Isaac Penard.—8. Oval watch, by Anthony; hands contract and elongate.—9. Crystal case watch, by Henry Grerdon.—10. Henry Ester's duck-shaped watch.—11. Crystal-case watch, form of fleur-de-lis.—12. Watch with spherical gilt case minutely chased; works swing so as to balance in all positions.—13. Crystal case mounted in bronze gilt; tulip shaped. French, 1700.—14. French lyre-shaped watch.—15. Small tulip-shaped watch, by Henry Grerdon.—16. Watch with metal case.—17. Acorn-shaped watch.—18. Drum-shaped watch.—19. Thin modern watch.—20. Watch charm, shape of drum.—21. Double chronograph, to fix on field glass.—22. Watch with seconds hand; crystal case.—23. Lord Hussey's watch.—24. Case for ditto.—25. Watch medallion.—26. Vase watch, 18th century.—27. Bracelet, with watch, to unfix.—28. Modern "half hunter."—29. Old-fashioned watch face.—30. Back of modern watch, enameled.—31. Back of modern watch enameled and set with pearls.—32. Crystal-case watch.—33. Silver-gilt watch in form of edged cross, decorated with garnets and crystals; German; 17th century.—34. Lady's gold watch, real size, initials and coronet in diamonds.

made in 1650, and said to have been the property of Oliver Cromwell. One bears the Cromwell family crest, and the inscription, "John Midnall, Fleet street." There is also another watch in the Ashmolean Museum, which without doubt was the great Protector's.

South Kensington has several watches of seventeenth century make. One is of silver, fluted, and shaped like a pecten shell. It has a chased and engraved dial, and bears the name of the maker, "Pierre Combrel à Lyon." Its size is two and a half by one and three quarters inches. Another watch is in the form of a fleur-de-lis, with gilt dial plate and outer case of plain silver. It dates about 1650, and its maker's name is "G. Senez, Orologier du Roy à Rouen."

The greatest improvements in the art of watchmaking are due to the seventeenth century, when the studious minds of Huygens and Dr. Hooke were directed into this channel. Dr. Hooke, an irrepressible and cosmopolitan "scientist," originated the spiral or pendulum spring, and this was improved upon by Thomas Tompion, who had been a farrier, and tried his prentice hand at watch-work by regulating the wheels of meat-jacks. Tompion was a famous watchmaker of the day, and Dr. Hooke induced him to construct a watch upon the new principle for Charles II. From this period watches became real timekeepers, and the improvements introduced since have been mainly to counteract the varying effects of cold and heat upon the metal of which the works are constructed, and in rendering the working parts less liable to friction, until the precision and mathematical accuracy of these machines justly entitled them to the eulogy of Paley, who selected watches as exhibiting the highest specimens of human ingenuity.

At one time it was fashionable to wear two watches, to compare the one with the other. In the "Universal Magazine" for 1777, we find a "Receipt to make a Modern Fop," which includes, among other ingredients,

"A lofty cane, a sword with silver hilt,
A ring, two watches, and a snuffbox gilt."

Some, too poor or too niggardly to sport the usual couple of watches, wore a *fausse montre*, or dummy watch, in one pocket, and the real watch in the other. This carrying of two watches at one time was as nothing compared to the whimsicality of a Saxon Minister, Count Brühl, in whose wardrobe, when the Prussians took Dresden in 1757, were discovered suits of clothes for each day of the year, and 365 watches, sticks, and snuffboxes, respectively.

We have seen that striking watches were of an early date, and stories are told of the detection of thieves in a crowd by the watches they had abstracted striking the hour at a *malapropos* moment. Charles XI. of France discovered a *chevalier d'industrie*, who had eased him of his watch in this manner. When "repeaters"—which strike the hour at any time by pressure upon a certain part of the watch—came in, seems to be unknown. They are mentioned in Bolingbroke's "Letters on the Study of History" (written about 1711, thus: "When you press a watch, or pull a clock, they answer your question with precision, for they repeat exactly the hour of the day, and tell you neither more nor less than you desire to know."

At South Kensington there are some beautiful specimens of seventeenth and eighteenth century repeaters. One is of metal gilt, in size 5⅛ by 4⅛ inches. Upon the dial plate is engraved the entombment, after Lucas Van Leyden. This watch is dated 1630, and the name of the maker, "Nicholas Lemandre à Blois," is added. Here is also a gold repeater in a shagreen case, by "J. Trubsham, London," the property of Miss Gerard, and said to have been formerly in the possession of Bishop Berkeley. Another in the same collection is believed to have been worn by George I. It is a repeating watch in a double case, the inner one being pierced and engraved, and on the back are the royal arms, surmounted by a crown. The outer case is *repoussé* and chased, with a horseman hunting a boar. It is 2¾ by 1⅛ inches in size, of German manufacture, the maker's name being "George Albrecht." A contrivance called a "pulse piece," and by the French a "deaf piece" (*sourdine*), was subsequently added to repeaters. In these watches a small button projected from the rim, nearly opposite the pendant, and when the watch was made to repeat the time, and the finger was pressed upon the button, the number of strokes upon the bell could be distinctly felt. The touch watch (*une montre de touche*) was a later invention by Brequet, a famous French maker. Here the hours were indicated by eleven buttons, or studs, projecting from the rim of the case, and the pendant marked twelve o'clock. There was an index hand at the back which, moved forward, stopped at the time shown upon the dial; this, combined with the studs, enabled one to feel the time.

Some of the last century watches are highly ornamented, and other specimens display great ingenuity. South Kensington has a French lyre-shaped watch, set with pearls and enameled, and surmounted by an image of the sun. Another, in the form of a very small apple, has a gold enameled case, and is surrounded by a belt of seed pearls. This was made at Geneva about 1760. In the Gardner collection at the same museum is a watch in an oval gold case, highly decorated with pearls and diamonds, set in enamel, the hands of which contract and elongate to suit the form of dial. This is by "W. Anthony, London." The clock of the cathedral of Lyon, made by Lippius de Basle, had a similar dial, and the single index became longer or shorter to suit its form. To return to the collection at South Kensington, there is a watch, the property of T. Dyer Edwards, Esq., originally belonging to the Duke of Marlborough, by whom it was given to Sir Isaac Newton in 1714. It is of silver, with *repoussé* and open work cover, and is of German make. Another watch presented to the great astronomer is in the possession of the Royal Society.

Miniature watches are little thought of now; precision is everything, as it should be; and this has culminated in the chronograph, a wonderful invention of our own day, by which the great horse races are usually timed. The precise moment the starter's flag is lowered is indicated upon the dial by a spot of ink, and another dot shows with equal exactitude the time at which the first horse passes the judge's chair.—Reprint from *Leisure Hou* in *Illustrated Christian Weekly*.

The Care of Steam Boilers.

INSTRUCTIONS TO BOILER ATTENDANTS.*

Getting Up Steam.—Warm the boiler gradually. Do not get up steam from cold water in less than six hours. If possible, light the fires over night. Nothing turns a new boiler into an old one sooner than getting up steam too quickly. It hogs the furnace tubes, leads to grooving, strains the end plates, and sometimes rips the ring seams of rivets at the bottom of the shell.

Firing.—Fire regularly.—After firing open the ventilating grid in the door for a minute or so. Keep the bars covered right up to the bridge. Keep as thick a fire as the quality of the coal will allow. Do not rouse the fires with a rake. Should the coal cake together, run a slicer in on the top of the bars and gently break up the burning mass. It has been found by repeated trials that under ordinarily fair conditions no smoke need be made with careful hand firing.

Cleaning Fires and Slacking Ashes.—Clean the fires as often as the clinker renders it necessary. Do not slack the clinkers and ashes on the flooring plates in front of the boiler, but draw them directly into an iron barrow and wheel them away.

Feed Water Supply.—Set the feed valve so as to give a constant supply, and keep the water up to the height indicated by the water level pointer. There is no economy in keeping a great depth of water over the furnace crowns, while the steam space is reduced thereby, and thus the boiler rendered more liable to prime. Nor is there any economy in keeping a very little water over the furnace crowns, while the furnaces are thereby rendered more liable to be laid bare.

Glass Water Gauges and Floats.—Blow through the test tap at the bottom of the gauge hourly, as well as through the tap in the bottom neck, and the tap in the top neck twice daily. These taps should be blown through more frequently when the water is sedimentary, and whenever the movement of the water in the glass is at all sluggish. Should either of the thoroughfares become choked, clean them out with a wire. Work the floats up and down by hand three or four times a day to see that they are quite free. Always test the glass water gauges and the floats thoroughly the first thing in the morning before firing up.

Blow-Out Taps and Scum Taps.—Open the blow-out tap in the morning before the engine is started, and at dinner time when the engine is at rest. Open the scum tap when the engine is running, before breakfast, before dinner, and after dinner. If the water be sedimentary, run down half an inch of water at each blowing. If not sedimentary, merely turn the taps round. See that the water is at the height indicated by the water level pointer at the time of opening the scum tap. Do not neglect blowing out for a single day, even though anti-incrustation compositions are put into the boiler.

Safety Valves.—Lift each safety valve by hand in the morning before setting to work to see that it is free. If there is a low water safety valve, test it occasionally by lowering the water level to see that the valve begins to blow at the right point. When the boiler is laid off, examine the float and lever and see that they are free, and that they give the valve the full rise. If safety valves are allowed to go to sleep, they may get set fast.

Shortness of Water.—In case the boiler should be found to be short of water, draw the fires if practicable, and draw them quickly, beginning at the front. In some cases it may be more convenient to smother the fires with ashes or with anything else ready to hand. If the fires are not drawn leave the furnace doors open, turn on the feed, lower the dampers, shut down the stop valve if the boiler be one of a series, and relieve the weight on the safety valves so as to blow off the steam. Warn passers-by from the front of the boiler.

Use of Anti-incrustation Compositions.—Do not use any of these without a thorough knowledge of their effects. If used, never introduce them in heavy charges at the man hole or safety valve, but in small daily quantities along with the feed water.

Emptying the Boiler.—Do not empty the boiler under steam pressure, but cool it down with the water in; then open the blow-out tap and let the water pour out. To quicken the cooling the damper may be left open, and the steam blown off through the safety valves. Do not on any account dash cold water on to the hot plates. But in cases of emergency, pour cold water in before the hot water is let out, and mix the two together so as to cool the boiler down gradually and generally, and not suddenly and locally.

Cleaning Out the Boiler.—Clean out the boiler at least every two months, and oftener if the water be sedimentary. Remove all the scale and sediment as well as the flue dust and soot. Show the scale and sediment to the manager. Pass through the flues, and see not only that all the soot and flue dust have been removed, but that the plates have been well brushed. Also see whether the flues are damp or dry, and if damp find out the cause. Further, see that the thoroughfares in the glass water gauges and in the blow-out elbow pipes, as well as the thoroughfares and the perforations in the internal feed dispersion pipe and the scum pipes are free. Take the feed pipe and scum troughs out of the boiler if necessary to clean them thoroughly. Take the taps and the feed valves to pieces; examine, clean, and grease them, and if necessary grind them in with a little fine sand. Examine the fusible plugs. Do not put any blocks under the pipes in the hearth pit.

Preparation for Inspection.—Have the boiler cooled and carefully cleaned out as explained above. Show both scale and sediment to the inspector, as well as the old cap of the fusible plug, and tell him of any defects that may have manifested themselves in working, and of any repairs or alterations that may have been made since the last examination.

Fusible Plugs.—Keep these free from soot on the fire side, and from incrustation on the water side. Change the fusible metal once every year, at the time of preparing for annual examination.

General Keeping of Boiler.—Polish up the brass and other bright work in the fittings. Sweep up the flooring plate frequently. Keep water out of the hearth pit below the flooring plates. Keep the space on the top of the boiler free, and brush it down once or twice a week. Take a pleasure in keeping the boiler and the boiler house clean and bright, and in preventing smoke.

* Sheet of instructions to boiler attendants recently issued by the Manchester Steam Users' Association.

MECHANICAL INVENTIONS.

A device for trimming tenons of wagon and carriage wheels, and also tenons of bars composing or forming part of the framework of wagon bodies, has been patented by Mr. Andrew P. Almquist, of New Windsor, Ill. It consists, essentially, of a wooden block having a cutter pivoted thereto for trimming the spoke tenons, and suitable gauges for supporting the spokes while being trimmed.

An improvement in power looms has been patented by Mr. Polydore Dorgeval, of Paterson, N. J. The invention consists in a lay or batten constructed in two portions, one portion consisting of the shuttle rail supported on arms that are vibrated by power, the other portion consisting of the reed carried by side arms hung on a shaft, which arms are moved to beat up by a weight. The reed frame is behind the shuttle rail, so that the backward movement of the reed is given by contact of the shuttle rail; also in a cam and link connection of peculiar construction for vibrating the batten and resting the same to give time for the passage of the shuttle. Fingers are pivoted on the shuttle rail and connected with slide blocks in the shuttle boxes, for movement by the shuttle to raise and hold the weft thread taut during the movement of the batten.

An improved sand band for vehicles has been patented by Mr. Jonathan Hitchcock, of St. Paul, Minn. The construction of this device cannot be clearly described without engravings.

Mr. John Ladner, of Charlestown, Mass., has patented an improved car starter, which is so constructed that the first effort of the horses will be applied to the wheels near their rims in such a direction as will roll the wheels forward, and will be withdrawn from the wheels automatically as soon as the wheels begin to move.

Mr. Joseph Curson, of Lyons, France, has patented an improved machine for shaving wool or hair from hides, which is provided with an endless knife passing over two pulleys and through suitable guides, to the cutting edge of which the hide is fed by a series of reciprocating and oscillating claws, and is pressed down upon the cutting edge by a roller.

An improved bark mill has been patented by Mr. Dennis O'Brien, of Oswayo, Pa. The invention consists in combining a radially-slotted stationary plate provided with grinding teeth on one edge of each slot with a wheel having teeth on the under side.

Mr. Theodore Naish, of Birmingham, County of Warwick, England, has patented an improved variable feed for rock and other drills. The inventor employs two friction disks, connected respectively with a shaft and the drill, which are arranged at right angles to each other, the edge of one disk working in frictional contact with the face of the other, but made adjustable along its shaft to vary its distance from the drill, so as to vary the rapidity of motion of the driven wheel.

Messrs. Arthur L. Bigsby and Charles L. Bigsby, of Trenton, Mo., have patented an improvement in positive motion looms, in which the shuttle is operated upon and moved continuously during its entire passage across the fabric being woven. The object of these improvements is to construct a loom in which two or more shuttles or colors may be used, and such shuttles shifted at each opening of the shed or longer intervals, as may suit the pattern being woven, and to furnish a more easy and positive motion to the shuttle, accelerating and diminishing its speed without any sudden start or stop.

An improved post-hole borer, patented by Mr. Henry Landin, of Forest, O., which consists in a yoke having toes, in combination with a divided nut and slotted bench and gearing. The operator sits on the bench and operates the borer by turning the cranks.

Mr. James S. Schoonover, of Titusville, Pa., has patented a compound crank, consisting of several cranks or eccentrics arranged spirally at equal distances apart upon a central shaft so as to form a complete spiral.

AGRICULTURAL INVENTIONS.

A simple, easily constructed machine for removing the hulls from cotton seeds and separating the hulls and kernels, has been patented by Mr. Seaborn Kitchens, Sr., of Gibson, Ga. When the seeds are hulled they are in good condition to express the oil therefrom, and they leave an oil cake free from waste, which is used for feeding animals.

Mr. Axel F. Bergqvist, of Fairfield, Iowa, has patented an improvement in sulky plows, which consists in the peculiar construction and arrangement of parts for raising and lowering the bail to which the plow is attached, and simultaneously adjusting the wheel which runs upon the land side.

An improved separator for removing cockle from grain has been patented by Mr. Eli Chapman Gage, of Whitehall, Wis. It is so constructed as to take out the cockle rapidly and thoroughly, and it is simple and convenient.

Glacier Pavements.

Speaking of the evidences of glacial action in the Sierra, Mr. John Muir, the California geologist, says that to the non-scientific observer the most striking and attractive are the polished glacier pavements, because they are so beautiful, and their beauty is of so rare a kind, so unlike any portion of the loose, earthy lowlands where people make homes and earn their bread. They are simply flat or gently undulating areas of solid granite, which present the unchanged surface upon which the ancient glaciers flowed, and are found in the most perfect condition in the sub-alpine region, at an elevation of from 8,000 to 9,000 feet. Some are miles in extent, only slightly interrupted by spots that have given way to the weather, while the best preserved portions are bright and stainless as the sky, reflecting the sunbeams like glass, and shining as if polished afresh every day, notwithstanding they have been exposed to corroding rains, dew, frost, and snow for thousands of years.

The attention of the game seeking and gold-seeking mountaineer is seldom commanded by other glacial phenomena, as moraines, however regular and artificial in form, or cañons, however deep, are strangely modeled rocks, however high and sheer; but when he comes to these bare pavements he stoops and rubs his hand admiringly on their shining surface, and tries hard to account for their mysterious smoothness and brilliancy. He may have seen the winter avalanches of snow descending in awful majesty through the woods, sweeping away the trees that stood in their way like slender weeds, but concludes that this cannot be the work of avalanches, because the scratches and fine polished striæ show that the agent, whatever it was, moved along and up over the rocks as well as downward. Neither can he see how water may possibly have been the agent, for he finds the same strange polish upon lofty, isolated tables beyond the reach of any conceivable flood. Only the winds seem capable of moving across the face of the country in the directions indicated by the scratches and grooves. Even dogs and horses, when first led up the mountains, study geology to this extent, that they gaze wonderingly at the strange brightness of the ground, and smell it, and place their feet cautiously upon it, as if afraid of falling or sinking.

The California Wine Crops.

The San Francisco *Alta* says that the California wine crop of 1880 was between ten and twelve million gallons. After mentioning the tendency of dealers to overstate the quantity of wine made, the *Alta* adds: "San Francisco has never received more than 3,500,000 gallons in a year, nor has the State ever exported more than 2,200,000 gallons in a year. The receipts at San Francisco were 1,700,000 gallons in 1876, 2,400,000 in 1877, 3,000,000 in 1878, 3,400,000 in 1879, and the same in 1880. The receipts of brandy were 60,000 gallons in 1876, 130,000 in 1877, 110,000 in 1878, and 100,000 in 1879. Our wine exports by sea were 510,000 gallons in 1876, 890,000 in 1877, 1,230,000 in 1878, 1,400,000 in 1879, and the same amount in 1880. The export by rail is about 800,000 gallons annually. The figures for 1881 will probably show a decided increase over 1880. The State has never approached the limit of its capacity in wine making, the greater part of the grapes having been used every year for the table, while many have been allowed to spoil on the vines, and the hogs have been turned into some vineyards, as the most profitable use that could be made of them. There have been years when grapes sold at Los Angeles and Sonoma for half a cent a pound at wholesale, and such low prices still prevail in large vineyards in the Sierra Nevada, remote from the market."

Traction Engines for Military Use.

An important experiment was carried out in Berlin the other day with a traction engine designed expressly for military purposes, in the presence of Field-Marshal von Moltke, General von Kamecke, the German Minister of War, General von Bülow, the Inspector-General of Artillery of the German Army, and a large number of other officers and officials of high rank. Five 15 cwt. guns, mounted on traveling carriages, with timbers complete, were attached to the engine; the whole forming a train a hundred paces long, weighing altogether 650 cwt. The gun carriages were attached to one another and to the engine by an ingenious coupling arrangement, designed to secure that the wheels of all the carriages should follow exactly in the track of the wheels of the locomotive. The invention appears to have succeeded perfectly, since the long train of carriages was taken without hitch or difficulty round very sharp corners; the traction engine and leading carriages at one point in the journey turning down a side street out of a main street before the rear carriages had entered the latter from another side street. The journey lasted for two hours and a half, the train moving with equal ease along paved streets and macadamized roads. The engine worked at a comparatively slow rate indeed; but it is said that it could have been driven at much greater speed, while it is also capable of dragging a load of 3,000 cwt.—*Continent and Swiss Times.*

The Sizes of Books.

Originally the terms *quarto, octavo*, and so on, denoting the number of foldings of the printed sheet, also designated the size of the book. But owing to the varying sizes of paper now used in bookmaking the size of a book can no longer be inferred from the number of foldings. Librarians are, therefore, adopting systems of arbitrary measurement for book sizes, retaining, however, the familiar denominations. The associated librarians of Great Britain recently fixed upon the following scale of measurements, the inferior limit of each size being the superior limit of the size below it:

Large folio	f°	over	18 inches.
Folio	f°	below	18 "
Small folio	f°	"	13 "
Large octavo	8°	"	11 "
Octavo	8°	"	9 "
Small octavo	8°	"	8 "
Duodecimo	12°		
Decimo-octavo	18°	is	6 "
Minimo	m°	below	6 "
Large quarto	4°	"	15 "
Quarto	4°	"	11 "
Small quarto	4°	"	8 "

To designate unusual sizes the additional terms *square* (sq.), *narrow* (na.), and *oblong* (ob.) are to be used. It would be a great convenience to book buyers if reviewers and advertisers of books could agree upon some such system.

Somatic Physics.

A suggestive paper on the applicability of the doctrine of the conservation of energy to biological studies was read at the recent Convention of Electricians at Chicago. The author, Dr. Clevenger, claimed that if any advances are to be made in these studies greater attention must be paid by physiologists to sound, heat, light, and electricity.

Tentatively the force which traverses nerve tissue may be regarded as electrical. There is no such thing as nerve force in the general acceptation. The author regards the nerves as paths of least resistance for the conveyance of force or forces existing in the universe and concerned in the life of every atom of the individual. The physical properties of foods and medicines have hardly been looked at, and the conquests of science remain to be made in the investigation of the laws of light, heat, and electricity in the production of plant and animal life. Latent and specific heats, the fluorescence of quinine and æsculin, force occlusion, and the ability of certain inorganic and organic bodies to yield up their heat, light, or electricity under appropriate conditions bear important relationship to therapeutics and physiology, and promise to make medicine a science of the most exact nature. In support the following phenomena may be cited: Light contracts the pupil of the eye as surely as electro-magnetism attracts the relay armature. Sound produces tympanic vibrations and excites muscular contractions. Heat produces general molecular changes of position throughout the body. Electricity is demonstrably held upon the large-sized nerve tissue of gymnotus and malapterurus, and nervous exhaustion follows every discharge. Electricity also produces muscular contraction. Gravitation does not lose its control of an atom for having entered into animal or plant composition. Coffee and sugar are related electrically, as zinc and platinum. Galvanometric deflections may be produced by a voltaic current generated by bitters and sweets, pungents and salts, bitters and acids. It is a rich field for investigation, bearing directly upon the problems the therapeutist seeks to understand.

Peruvian Torpedo Tricks.

In an account of the defenses of the city of Lima, a native of that city lately gave to the *World* the following account of the use of torpedoes by the Peruvians. He said:

"You recollect the destruction of their transport Loa by a torpedo concealed in a fruit boat which was turned adrift in such a way as to fall into their hands. The unloading of the fruit from what appeared to be an ordinary market boat set some clockwork in motion, and when the 300 pounds of dynamite exploded the Loa was destroyed and sunk in less than ten minutes. The corvette Covadonga was destroyed in pretty much the same way. This vessel was bombarding Chaucay, a small port about forty miles from Lima, when a small boat, 'got up' to look as if it was the gig of the captain of the port, came out to her. The corvette suspecting something wrong fired on the small boat, and its crew at once jumped overboard and swam ashore. The Chilians sent a launch after the boat. They were very cautious about it, for their Admiral has issued orders to them to keep clear of all boats adrift. Well, they passed a rope under it to see that it was really clear of any wires, had it examined by a calker to be sure that there was no false bottom, and even then were not satisfied, but had an engineer from the corvette go out and look the boat over. These doings were very closely watched from the shore, I can tell you. Finally they seemed to determine that the small boat was all right, and the launch took her in tow to the side of the corvette. They attempted to hoist her up, but as soon as the weight of the boat came on the rings at each end of her a steel rod accurately gauged to break with a certain weight snapped, and 300 pounds of dynamite stowed in the air chambers along each side of the boat exploded and in ten minutes the Covadonga was sunk. The men on shore hurried out in boats, and the launches of the corvette, which were out doing patrol duty, also helped to pick up the men in the water. Out of 160 men on board about forty were saved.

"The last attempt to use the torpedo was not successful. It took place about twenty days before I left Lima. The iron-clad Blanco Eucaleda is detailed to keep the blockade at Callao, and has an anchorage ground off the corner of the Island of San Lorenzo, which forms one side of the harbor. It was her custom to put out to sea every night to be safe from any night attacks in small boats. Every morning about 8 o'clock she returned to her buoy to anchor for the day. We arranged a sunken torpedo of two boats fastened together and sunk just under that spot. The explosive was 8,000 pounds of black powder. Clockwork was set to explode the mass at 9:30 in the morning, and at that time there was a great crowd on the shore watching the vessel, expecting to see her 'go up,' for she had come in and anchored in her old spot. But it seems that the tide, which sets very strong at that point, had carried the torpedo about half a mile away, and all we had was a very fine waterspout. Now the Blanco Eucaleda goes out to sea as usual every night, but leaves several launches to patrol the anchorage ground."

Post-mortem Examination of a Crazy Elephant.

African Jim, an elephant belonging to the St. Louis Zoological Gardens, died recently after an illness of two months. On the evening of his death he exhibited an uncontrollable desire to smash things, and endeavored to tear down the building containing the carnivora. A *post-mortem* examination was made by Dr. Charles A. Todd, who found the body somewhat emaciated.

The abdominal organs were healthy, with the exception of the liver, which was congested and showed abundant signs of old disease—inflammation. There had been an old pleurisy, or inflammation of the membrane covering the inside of the chest and surface of the lungs, which caused both lungs to be closely bound to the chest at every point, so that they were no longer freely movable, as should be the case. The lungs were also partly congested. The brain was the site of the most important pathological changes. The membranes covering it were greatly congested, and the one that lies direct in contact with the nervous substance (pia mater) was markedly thickened (showing old inflammatory disease), the blood vessels passing into it being also thickened and offering considerable resistance in the examination. Other parts of the brain were congested. The congested condition of the brain and its membranes explained the frenzy of the animal on the day of his death; this, however, was but a sudden aggravation of the long standing disease indicated by the thickened membrane and vessels, chronic meningitis, which would have insured a premature death, even if life had not been so suddenly taken off by the last attack. In human beings chronic meningitis is a disease difficult to diagnose until symptoms of paralysis, weakness of mind, marked headache, forgetfulness, appear to suggest what the ailment may be. Dr. F. R. Eversole, who assisted Dr. Todd, stated that in his experience at the City Insane Asylum he had not seen more decided evidence of brain disease of a chronic nature in the *post mortems* there held upon the bodies of chronic cases. The elephant during life did exhibit symptoms that might have been supposed to proceed from slight headache, but his chief symptoms were failure in appetite for grain, with consequent emaciation. It should be remembered that the stomach contained an abundance of well masticated fodder, and there was no indication of disease of the intestinal tract or disturbance of its functions. The matter is one of great interest to keepers of wild animals, as this elephant evidently had been liable for some time to outbreaks of violence.

A Defense of American Pork.

The Secretary of the Treasury recently transmitted to the Senate a report on the alleged occurrence of trichinæ in American hams and other meat in Germany and elsewhere. The report was prepared under the direction of the Surgeon-General of the Marine Hospital Service, and was called out by letters received from United States consuls in foreign parts, one of which, from the Consular Agent at Mayence, states that on investigating the reports of the finding of trichinæ in American pork it was found that the infected meat was not American but German. The Senate report says that the number of diseased swine is overestimated, probably through the influence of those most interested—the German pork dealers and producers.

The One Mechanic Buried in Westminster Abbey.

Notwithstanding England's enormous indebtedness to her mechanics, but one mechanical workingman has ever been honored with a burial in Westminster Abbey; and that was Graham the clock-maker. Graham made exact astronomy possible by his great improvements in time pieces. He invented the dead-beat escapement and the gridiron compensating pendulum, and he was the first to make clocks that would run for many days without winding. Graham was also a maker of great quadrants and instruments of that sort. His funeral was attended by all the members of the Royal Society.

Antiquity of Trade Marks.

The question has been asked somebody, "How old are trade marks?" who answers it by saying that they seem to be nearly as old as the industry of the race.

Ancient Babylon had property symbols, and the Chinese claim to have had trade marks 1,000 years before Christ. Guttenberg, the very inventor of printing, had a lawsuit about a trade mark, and he won it. As early as 1300 the English Parliament authorized trade marks, and the laws of America have always protected them. The theory by which a suit is brought for infringement of a trade mark is that its use deprives the originator of his property, and deceives the public as to the article. Extraordinary means have been required at all times to guard against the fraudulent use of marks of manufacturers.

In ancient times the greatest importance was placed upon the marks of individual workmen, because, as in the case of the armorers, valuable lives often depended on the quality of the workmanship. One old author complains that certain good and true soldiers were killed simply because the workmanship of their swords and arms was not good, and failed them when in battle. Very early, therefore, it was found necessary to make stringent laws against counterfeiting trade marks, and against scamped workmanship. Without protection in this one particular, trade would almost come to a standstill, because there are very few things, comparatively, that can be purchased upon their merits, judged at the moment. In general, we know the quality of goods by experience, and it is only after they have been in use that a certain judgment can be pronounced upon their quality. Having, then, once found that a certain workman's productions are good, we seek them again in the market. If we have no means of identifying his trade mark the whole work of buying becomes a haphazard affair. The best goods at once lose their value. This was early discovered, and probably the successors of Tubal Cain were the first to use distinctive marks on their manufactures.—*The Carpet Trade Review.*

Curious Uses and Works of Ants.

At the recent Southboro session of the Massachusetts State Board of Agriculture, Prof. E. S. Morse gave the following curious particulars about ants:

The ant belongs to a family of insects such as wasps, bees, hornets, but is the superior of them all, as are the elephant, the horse, and the dog, in other lines of animal life. Ants are constructed with the "back" bone in front, and the heart and other internal organs on the opposite side are put together upside down, as we might think. Their mouth is for biting and swallowing food only, not for breathing. Their bite is so determined and lasting that they are used in some countries for confining the edges of wounds and cuts. Ants' heads are presented to the cut surface, which they grasp with their nippers, when their bodies are cut off leaving a whole row of them to hold the flesh. They are cheaper than sticking plaster in some countries.

As an illustration of their ingenuity and intelligence, it was stated that they sometimes excavate tunnels under rivers of considerable depth and width, and use the tunnels for transporting supplies. They dig wells twenty feet deep and a foot in diameter for drinking water. The harvesting ants plant seeds on farms, which they cultivate with great skill and neatness, keeping every weed down and harvesting the grain, curing and storing it safely in weather-proof cavities in the soil. They also organize into divisions with commanders, each individual doing a certain kind of work. Some ants are smart enough for engineers, while others only know enough to do as they are told. They can count and make correct estimates of the magnitude of an undertaking, as proved by observers.

Eight chrysalides (often called the eggs of ants) were placed in a path where ants travel. A single individual found them and undertook to remove them to their home. Several were carried by the single ant patiently enough, but when twenty chrysolides were placed in the heap, another ant was found engaged in the work. The pile was increased at intervals till eighty ants engaged in the undertaking, showing that workers were detailed according to the demands of the cases.

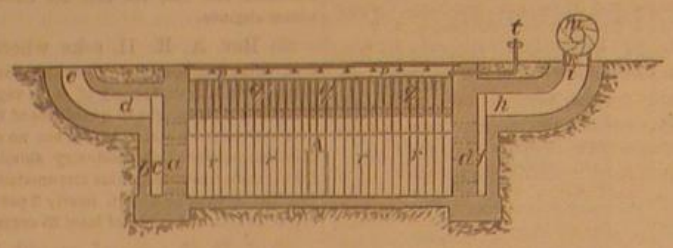
Ants' battles sometimes last many days, in one case seven weeks, the victors finally taking the stores and removing them to their own houses. Their wars are quite as justifiable as those of men, when the object—pillage—is the same. They have the power, too, of knowing members of their own communities even after six months' absence. Strangers are always driven off or killed. They are very helpful to each other, and show sympathy in case of accident or sickness. Some families of ants build arched roads covered by an arch of clay or mortar for protection against enemies, and show great skill in the work, which is under the supervision of trained engineers, who order a rebuilding if the work is not perfect. Some kinds of ants keep cows, build cow-yards, and milk their cows regularly, and don't throw milking stools at them either to make them "give down," but pat and stroke their backs very tenderly. Of course these cows are the plant aphides so familiar to all farmers and gardeners.

A Locust-killing Beetle.

In the neighborhood of the site of ancient Troy, Sir John Lubbock finds a beetle which in both its mature and its larval condition preys upon locust eggs. The beetle is said to be very voracious. What it lives on when locust eggs are out of season does not appear. If it is not mischievous at such times, the beetle might play a good part in helping to exterminate the locusts of our Western Territories.

CELLAR FOR MANUFACTURING ICE.

From the water reservoir, *p*, which is fed by the pipe, *t*, water falls through the funnel-shaped openings, *q*, upon the threads, *r*, into the cellar, and is brought there to the freezing point soon after the exhaust fan, *m*, is set in motion. Ice can be made only when the temperature of the atmosphere is low. The air enters through the channel, *e*, *d*, *c*, and through the openings, *a*, into the cellar, A, and is drawn through similar openings, *a*, and the channel, *f*, *h*, *i*, by the exhaust fan, *m*.



CELLAR FOR MANUFACTURING ICE.

HUMAN FOOTPRINTS IN KENTUCKY SANDSTONE.

Through the courtesy of Mr. M. Robinson, of Shawneetown, Ill., we are able to lay before the readers of the SCIENTIFIC AMERICAN a picture of what is probably the earliest human "footprint in the sands of time," that has come to the light of day.

The track from which the photograph was taken is one of three occurring in a block of sandstone in Union County, Kentucky, about a mile and a quarter from the Ohio River. The stone is very hard, and the stratum containing the tracks (or, rather, which originally contained the tracks, for they have lately been cut out) is said to be from fifteen to twenty feet thick and to lie at an angle of 21°. The buried portion underlies shale. The exposed portion would seem to have formed at one time the bank of the river, and the tracks were within a few feet of the edge of the rock. The age of the rock is uncertain. Mr. Robinson says it "is thought by those best posted here to have been below the coal measures."

HUMAN FOOTPRINTS IN KENTUCKY SANDSTONE.

The track represented in the engraving is now in the possession of Mr. Robinson. It measures ten inches in length and five inches across the spread of the toes. The foot appears to have slipped forward in making the track, thus elongating the heel mark and spreading the toes. Of the other two tracks, Mr. Robinson says that one, eleven inches long, was sent to a museum in Danville, Kentucky. It was badly defaced, but enough was left "to tell nearly all about the foot." The third track was too much defaced to be of any value, but whether in the act of cutting out, or by being weather-worn, Mr. Robinson does not say.

The tracks have been known almost from the first settlement of the county, but the former owner of the land would not let them be touched. The present owner gave Mr. Robinson permission to remove them only recently.

The geological value of these fossil footprints it is obviously impossible to estimate at this distance. It is to be hoped that the matter will be carefully investigated by some geologist so well known as to give his report assured scientific value. The lines crossing the track are cracks in the rock, which have been filled, it is inferred, by infiltration.

MISCELLANEOUS INVENTIONS.

Mr. Carl Posen, of Offenbach-on-the-Main, Germany, has patented an improved fastening for pocketbooks and other articles, which is so constructed that they may be easily and conveniently fastened and unfastened, and it presents a neat and finished appearance.

An improvement in eyeglasses has been patented by Mr. Robert Kabus, of New York city. The object of this invention is to simplify and cheapen the construction of eyeglasses and to render them more convenient for use.

An improved drop gate has been patented by Mr. James Beezley, of Rocky Ford, Col. The object of this invention is to furnish drop gates so constructed that they may be conveniently opened and closed by persons riding in a carriage or on horseback.

An improved device for securing wheels to axles has been patented by Mr. Thomas H. Outerbridge, of Hamilton, Bermuda, the object of the invention being to dispense with the screws and nuts generally used for that purpose, and to furnish a lock that shall secure the hub safely to the spindle and can be readily manipulated.

The sheets of gaff-topsails on vessels are led through sheaves at the outer end of the mainsail gaffs, and it frequently occurs that the sheets part or unbend from the sail and unreeve from the gaff, so that a man must be sent out on the gaff to reeve the sheet or the gaff and mainsail lowered to the deck for the same purpose. To lower the gaff, especially if the wind is fresh, involves considerable wear and tear on the sails and rigging, besides loss of time and labor, while the work of passing out on the gaff to reeve the sheet is the most hazardous undertaking required on vessels, as there are no footropes, beckets, or other conveniences to insure safety, and loss of life by men being thrown from the gaff is of frequent occurrence. Mr. Frank B. Cort, of Holyoke, Mass., has patented means for reeving gaff-topsail sheets, rendering such work safe and rapid. The invention consists in the combination with the gaff of an endless rope fitted to run in the throat and end sheaves of the gaff, so that the top-sail sheet can be rove from the deck or from the throat of the gaff.

Mr. Green Smith, of Coal Valley, West Virginia, has patented improvements in that class of windows designed to secure the benefits of ventilation through the entire area of the window, to permit the window-panes to be washed on both sides without taking out the sash or going outside of the window, and to secure the balancing of the sashes, the independent movement of either sash, or the entire removal of the sashes, as may be desired.

Mr. Robert B. Herskell, of Wallingford, Conn., has patented an improved apparatus to facilitate the coating of spoons, forks, and similar articles with a plating or covering of metal, so that the thickness of the plating metal shall vary at different parts of the articles, as desired, the thickness being greatest upon the parts most exposed to wear.

An improved fan, patented by Mr. Max Rubin, of New York city, relates to that class of fans on which the wing or web folds between two handles and opens into circular form when in use, and has for its object to make the fans more convenient in use and less liable to get out of order than fans constructed in the usual manner.

An improvement in steel earth scrapers has been patented by Mr. William Haslup, of Sidney, O. It consists in the means for fastening the handles to the sides of the scraper, and in curved and flanged socket plates arranged on the inner walls of the scraper to receive the ends of the backboard.

Messrs. Sylvester J. Tucker and Robert F. Williams, of Richmond, Va., have patented a street car which is convertible at will, by a simple adjustment, either into a summer or winter car.

A machine for fitting and putting together the several parts of a wagon wheel has been patented by Mr. William Casady, of Milton, Iowa. The invention consists of felly-boring, spoke-tenoning, and spoke-gauging devices combined in one machine.

Mr. George E. Bales, of Walla Walla, Washington Ter., has patented an improved snap-hook and buckle for breast-straps, hitching, and other straps or lines on which snap-hooks are commonly used. This snap hook is more easily unsnapped and less liable to become clogged with ice or mud than those now in use.

An improved bale tie has been patented by Mr. Thomas B. Taylor, of Mount Meigs, Ala. The object of this invention is to apply bale ties and bands in such manner that the bands will not turn upon the bales when being tightened, and will be securely held, retaining the compression by preventing the bale from swelling when the pressure is withdrawn.

A block of artificial stone formed of pitch, cement, sand, and embedded surface pebbles, the latter planed down, to exhibit their various colors, has been patented by Mr. George W. Mason, of Sharon, Pa.

An improvement in machines for folding the edges of collar and cuff blanks, preparatory to sewing, has been patented by Mr. Max Hermann, of Troy, N. Y. The machine folds the blanks ready for being placed together, and attached by a single line of stitching.

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.

(1) H., referring to the reply to A. R., December 18, writes: Here is a plan for removing foreign substances from the eye, which has given relief in a number of cases not only from cinders but other substances. Holding the eyelash, draw the upper lid down as far as possible over the lower lid. In nine out of ten cases the lower eyelash will brush off the cinder.

(2) W. R. S. asks: 1. Will it require more fuel to evaporate a certain quantity of cane juice by steam than by heat applied directly to the bottom of the evaporator? A. No. 2. Would evaporating by steam make a lighter sirup than and be preferable to heat applied directly to the evaporator? A. It would, unless great care were used in direct firing under the kettles. 3. What should be the heating surface of a boiler to insure the evaporation of two hundred and fifty gallons of cane juice to a dense sirup in one hour? How high a pressure would be required to secure rapid evaporation? What form of boiler would be best adapted to this purpose? A. 750 to 800 feet heating surface; the higher the pressure the more rapid the evaporation. Any good boiler will answer, but if you use a tubular boiler, increase the heating surface 20 per cent. 4. What size steam pipe should be used? A. Two and a half to three inches diameter.

(3) J. C. R. writes: I see an inquiry about cutting screws with foot lathe slide rest (No. 11 in Notes and Queries, SCIENTIFIC AMERICAN, No. 25), and would say that I have had my slide rest arranged for this purpose for years. The screw of slide rest projects beyond the bed plate of the rest about one inch, and is supported by a bearing screwed to the botton plate of slide rest. A brass plug is screwed over end of screw; one end carries a gear, while the other end runs in bearing. There is a wheel on mandrel, which runs wheel on end of slide rest screw to cut right hand thread; to cut left hand screw I use an intermediate wheel. The slide rest bed is fourteen inches long, if the screw to be cut is too long or far off for the wheel on the screw of the rest I put it on a hollow shaft attached to the lathe so as to be turned by wheel on mandrel. I pass a rod through the hollow shaft and connect one end of it with the slide rest screw so as to be firm, then it is fastened in the hollow shaft by a binding screw, so as to revolve.

(4) W. A. writes: 1. I want to know the simplest accurate way to find the horse power of a boiler. A. From twelve to eighteen square feet of heating surface is allowed per horse power, the larger proportion for tubular boilers. 2. Manufacturers generally give the size of boiler, flues, and fire box. Do you allow the same number of square feet to horse power for grate as flue surface? A. The grate surface should be equal to one-twenty-sixth to one-thirtieth the heating surface. 3. Does dividing the square of the diameter of the cylinder by four give you the horse power of an engine? If not, how do you find it out? A. We refer you to SUPPLEMENT, No. 253, for rule for calculating power of steam engines.

(5) Rev. A. R. H. asks whether it would be profitable to establish, in connection with one of the creameries, a manufactory of milk sugar, provided the whey could be bought in quantities of 6,000 quarts daily, at a half cent a quart. A. We see no reason why, with good management, the industry should not prove profitable under such favorable circumstances. If properly conducted you can obtain nearly 3 per cent of refined sugar, which will bring at least 35 cents a pound.

(6) J. R. H. says: I would like to know the kind of machinery used for making oil from cotton seed and the manner in which it is done, the cost of fixture, and the amount of oil per bushel of seed. A. The seed is passed through a hulling machine, usually consisting in a set of rollers geared so that the surface of one travels faster then the other. This crushes the seed and loosens the hull, which is separated by sieves. The decorticated seed is then ground in a mill, then submitted to hydraulic pressure. Before pressing the meal it is usually heated in a steam jacketed vessel provided with a mechanical stirrer, to facilitate the expressing of the oil. According to Sims' process the oil is extracted from the meal by liquid solvents, bisulphide of carbon, or hydrocarbon oils; 56 lb. hulled seed yield about 2 galls. oil. The huller, mill, and press are the principal pieces of machinery required. Address the dealers who advertise in our columns.

(7) J. T. McC.—Brass work may be brightened with a little oxalic acid dissolved in water and applied with a cloth or brush.

(8) M. Y. D. asks how vanilla bean must be prepared for flavoring ice cream. A. Macerate the pulped bean and percolate with alcohol; dilute the strong extract with water, and filter, if necessary, through white paper.

(9) C. R. M. and others ask how to engrave glass by means of the sand blast? A. Sand driven by an air blast of the pressure of four inches of water will completely grind or depolish the surface of glass in ten seconds. If the glass is covered by a stencil of paper or lace, or by a design drawn in any tough elastic substance, such as half dried oil, paint, or gum, a picture will be engraved on the surface. Photographic copies in bichromated gelatin from delicate line engravings have been thus faithfully reproduced on glass. In photographic pictures in gelatin, taken from nature, the lights and shadows produce films of gelatin of different degrees of thickness. A carefully regulated sand blast will act upon the glass beneath these films more or less powerfully, in proportion to the thickness of the films, and the gradations of light and shade are thus produced on the glass. In the apparatus used air rises through a curved tube, carrying the sand up with it, which is thrown into the air tube by an endless belt of scoops arranged in the lower part of the angular box. The sand is carried up by the air and brought over and down the front air tube, where it discharges with great force upon the surface of the glass, which is contained within the front box and is carried by a belt gradually forward under the blast.

(10) R. A. C. asks how to prepare wax for waxing floors. A. Two oz. of pearlash, 16 oz. of wax, and about half a pint of water are heated to boiling in a dish, which is frequently agitated, until a thick fluid mass is formed, from which, upon removal from the fire, no watery liquid separates. Boiling water is now cautiously added to the mass, until no watery drops are distinguishable. The dish is again set on the fire, but its contents are not allowed to boil (otherwise myricin would separate out), eight or nine pints of water being added, little by little, with constant stirring. Coloring matter may be added if desired.

(11) A. V. asks how to harden thin steel plates, so as to avoid springing and cracks. A. Fill the holes with fire clay and wire to keep it in place. Heat evenly and slowly in a furnace. Lift the dies from a furnace with the face vertical, and plunge vertically into water heated to about 50° and containing about a half pound salt per gallon. Hold them still at the bottom of the water until cooled.

English Patents Issued to Americans.

From December 10 to December 14, 1880, inclusive.

Brake, G. Westinghouse, Jr., Pittsburg, Pa.
Electric drill, C. E. Ball, Philadelphia.
Furnace and boiler for heating purposes, S. W. Underhill, Croton Landing, N. Y.
Gas regulator, H. Barlow, New York city.
Hoisting apparatus, F. G. Johnson, Brooklyn, N. Y.
Horn blowing apparatus, W. B. Barker, Hoboken, N. J.
Horseshoe nail machine, A. Coleman, Providence, R. I.
Lamp, W. B. Robins, Cincinnati, Ohio.
Mould forming apparatus, S. J. Adams, Pittsburg, Pa.
Ore crusher, F. A. Luckenbach *et al.*, New York city.
Railway vehicles, J. W. Chisholm, Brooklyn, N. Y.
Shaft coupling, T. R. Almond, New York city.
Sweat band, T. W. Bracher, New York city.
Telegraph, H. Van Hoevenburgh, New York city.
Telegraphy, S. L. M. Barlow, New York city.
Telephone, S. L. M. Barlow, New York city.
Telephone, T. A. Edison, Menlo Park, N. J.
Vegetable fibers, preparation of, J. G. Stephens, Jersey City, N. J.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

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

December 14, 1880,

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 one dollar. In ordering please state the number and date of the patent desired and remit to Munn & Co., 37 Park Row, New York city. 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.

Addressing machine, W. W. Ames 235,485
Amalgamating mortar, J. S. Buck 235,505
Animal trap, W. J. H., & T. D. Morris 235,553
Anti-chafing device, E. Wells 235,509
Axle arms for wagons, apparatus for dressing, R. R. Miller 235,573
Axle box, S. Marsh 235,546
Axles, machine for shaping the arms or spindles of, J. Kritch 235,440
Bale band tightener, L. Miller 235,550
Baling press, M. Loeser 235,542
Band cutter, J. L. & W. E. Alexander 235,483
Barrel drying apparatus, E. & B. Holmes 235,531
Bed spring, E. L. Bushnell 235,508
Bedstead, wardrobe, S. Winslow 235,479
Beehive, D. D. Fowles 235,570
Beer cooler, J. G. Müller 235,554
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Bit brace, G. L. Holt 235,532
Bit brace, S. Rightmyer 235,580
Blacking and burnishing the edges of seam stays, machine for, Nichols & Lancaster 235,557
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Box fastener, H. F. Billings 235,335
Bridge links, device for manufacturing, R. W. Rogers 235,455
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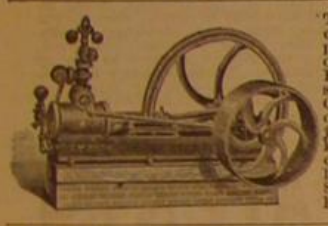

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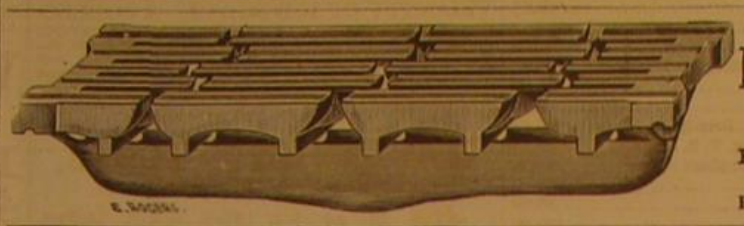

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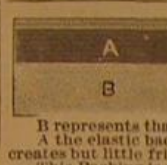

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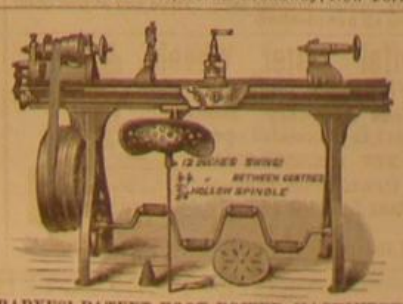

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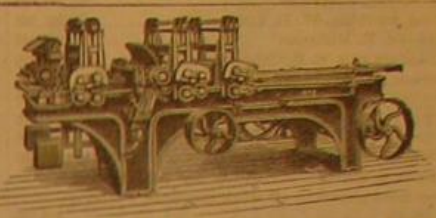

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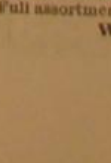

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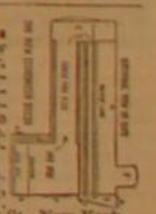

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[Entered at the Post Office of New York, N. Y., as Second Class Matter.]

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

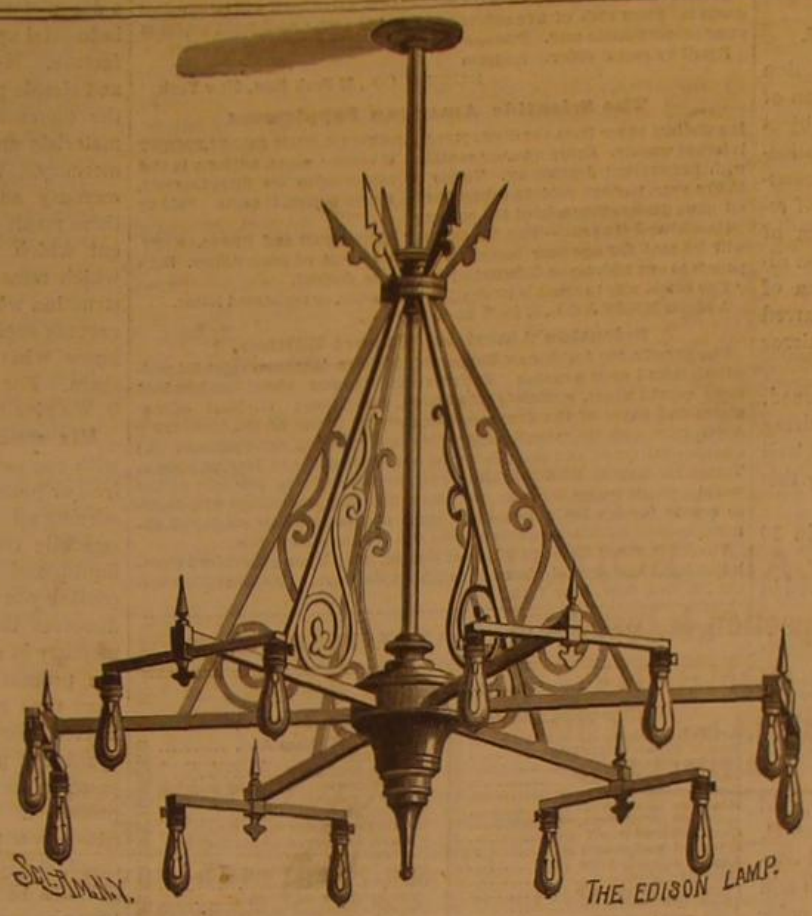
Vol. XLIV.—No. 4. [NEW SERIES.] NEW YORK, JANUARY 22, 1881. [$3.20 per Annum. [POSTAGE PREPAID.]

EDISON'S NEW DYNAMO-ELECTRIC MACHINE.

The remarkable activity prevailing at the Menlo Park laboratory and machine shop, and the evidences of the enormous outlay of capital which one sees at these works on every hand, are convincing proofs of the good faith and thorough earnestness of Mr. Edison and his co-laborers and supporters. The great work of perfecting a complete system of electric lighting in all its details is necessarily a very slow operation, however much the work may be urged, as time-tests of the endurance of lamps, perfection of the insulation of the underground conductors, and a hundred other time-consuming operations must, of necessity, be gone through with.

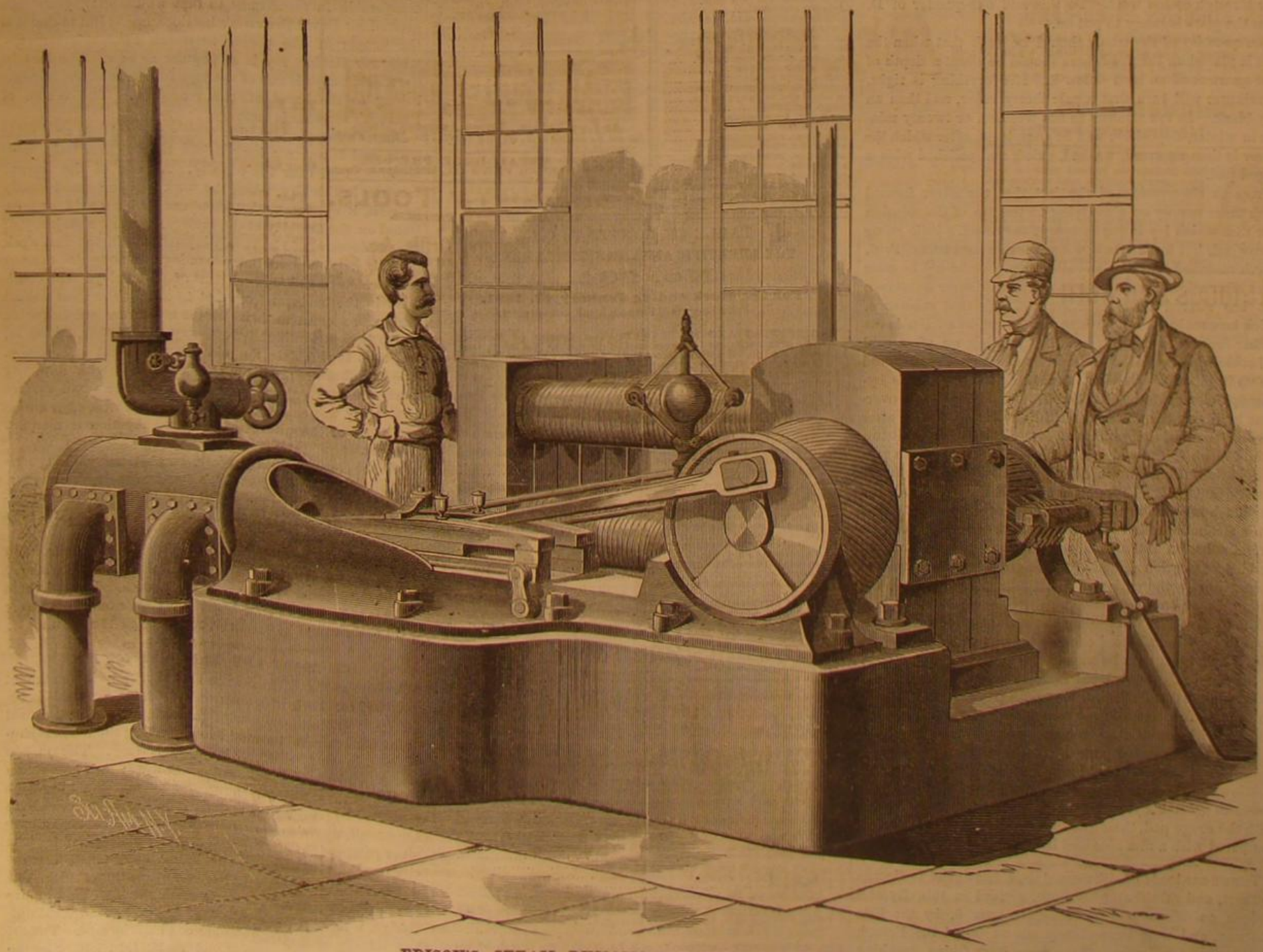
As it is Mr. Edison's determination that his system of electric illumination shall not be presented to the public until it is complete and commercially practicable to the smallest detail, the would-be-users can afford to wait patiently for the perfected thing, rather than be subjected to the trouble and possible disappointments attending the perfecting of the system while it is in public use, as is commonly the case with great inventions.

Besides carrying to a successful issue the grand experiment of illuminating a large out-of-door area with incandescent lamps, Mr. Edison has practically demonstrated that the highest economy in the conversion of power into electricity can be reached only by the use of very large machines, and by the direct application of the power to the armature without the intervention of belts or other means of transferring power.



THE EDISON LAMP.

Our engraving represents a gigantic dynamo-electric machine approaching completion at Mr. Edison's machine shop, and designed to replace sixteen of the largest machines of this kind previously made. The dynamo and the driving engine are both mounted on a massive cast iron bed, 8½ by 7 feet and 2 feet deep, very heavy and strongly ribbed, the entire machine weighing 8 tons. Near the middle of the bed is mounted the dynamo-electric machine, which, we believe, is the largest ever constructed. Its field magnets, three in number, are 6½ feet long. The armature is 21 inches in diameter and 28 inches long, and weighs 1½ tons. The engine is 100 horse power, of the Porter-Allen type, built especially for this purpose at the Southwark Foundry, Philadelphia. Its stroke is 10 inches. The internal diameter of its cylinder is 9 inches. The crank disk is placed on the end of the armature shaft. Steam pressure, 120 lb. per square inch. The engine cuts off at one-fifth of the stroke and makes 600 revolutions per minute. The working pressure of the dynamo is 140 volts; the resistance of the armature is one two-hundredth of an ohm.



EDISON'S STEAM DYNAMO-ELECTRIC MACHINE.

The current is taken from the commutator cylinder by twelve brushes, six on either side, either one of which may be removed without disturbing the others. These brushes are supported by an arm capable of being rotated on an axis coincident with the axis of the armature, so that they may be made to approach or recede from the neutral point, and in this manner control the current.

This machine will furnish a current to eight hundred incandescent lamps. According to the most recent estimates as to economy, as obtained by indicating his present engine with 500 lamps, three and a half pounds of coal burned under the boiler per hour will generate a nett current sufficient for 8¾ incandescent lamps of 16 candles each, or 16 lights of 8 candles each.

IMPROVEMENTS IN THE SILVERING OF MIRRORS.

Astronomers, and all who are interested in the production of mirror surfaces for optical purposes by the deposition of silver upon glass, will learn with pleasure that this subject has been receiving practical attention at the hands of a painstaking experimentalist, Professor Piazzi Smyth, the Astronomer Royal for Scotland. Convinced of the great value of reflecting over achromatic telescopes for certain phases of astronomical research, Professor Smyth has lately been directing his attention to the eliminating from the film of deposited silver certain objectionable features which marred its usefulness when applied to the reflector or glass mirror of large reflecting telescopes.

Subject to slight improvements to be afterward mentioned, the quickest, best, and most reliable method of depositing silver on glass, and that by which large glass specula as well as flat reflectors for a heliostat have been prepared by this astronomer, is the following:

Solution A.—175 grains nitrate of silver dissolved in 10 ounces of distilled water.

Solution B.—262 grains of nitrate of ammonia dissolved in 10 ounces distilled water.

Solution C.—1 ounce of caustic potash, purified by alcohol, in 10 ounces distilled water.

Solution D.—Half an ounce of sugar candy and 32 grains tartaric dissolved and boiled for ten minutes or so in 5 ounces distilled water. When cold add 1 ounce of alcohol, and make up to 10 ounces with water.

To Mix.—Put one-quarter of A into a glass beaker, add one-quarter of B, and then, gradually, one-quarter of C. Stop if it gets cloudy and add a drop or two of B, and continue with one-quarter of C until it is all got in. Then add a drop or two of A till the mixture has a slight brown color that will not dissolve in a couple of minutes; let it settle, or filter through cotton wool. To this add one-quarter of D, when the glass is ready to put on.

The quantity of the whole should be such that when the glass is placed on the fluid there should be about a depth of three-quarters of an inch below it. If everything is right, the mixture will turn first a pale sherry color, and then an inky black. In ten minutes in hot weather, or twenty minutes in winter, deposition will be completed, after which the mirror is then removed, washed, dried, and polished with a rouged pad.

From an observation of the fact that the silver formed much more readily on glass lying on the top of the solution than that which lay in the bottom of the vessel, a little going downward, but by far the greater portion ascending, Prof. Smyth reasoned that the so-called silver could not be pure silver after all, but must be combined with some substance that has altered its specific gravity. To that substance, which he concludes is potash in some form, he attributes the further fact that a damp warm thaw coming on after cold will sometimes cause the polished film to leave the glass and rise up in blisters. By what means, therefore, was this hygroscopic element to be eliminated? All difficulties are overcome by lifting the mirror from the silvering bath, and after allowing some of the solution to drip off, transferring it to a bath of alcohol, into which it is allowed to remain, with gentle agitation, till no more coloring matter is given off. A great advantage is also found in the substitution of soda for the potash in solution C, using much less of it. The effect of the alcoholic bath is noteworthy and valuable. A more perfect adhesion to the glass, with consequent freedom from the blisters mentioned, added to the greater smoothness and amenability to the action of the rouge polishing pad, are among these advantages.

An effective way of cleaning the surface of the glass previous to its being silvered consists in rubbing it with nitric acid, which must then be wiped off with a cloth, followed by an application of powdered Spanish whiting, to which is added enough distilled water to make a paste. This is rubbed over the surface and allowed to become quite dry, when, by rubbing with cotton wool, it is all removed. On being seen to be dry and clean the plate is gently lowered, face downward, into the solution, taking care not to sink it so low as to allow the back to get wetted. The film thus obtained possesses great body, solidity, and luster after being rubbed with the rouge pad, these qualities being very apparent when compared with a film obtained by the older processes.

THREE car loads of silkworms' eggs, consigned to George Carhart, and valued at $1,000,000, arrived in this city at 6 o'clock on Wednesday morning, January 5, by the Erie Railway, and were immediately put on board the French line steamer for France. They came from China, reaching San Francisco on the 28th ult.

Scientific American.

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NEW YORK, SATURDAY, JANUARY 22, 1881.

Contents.

(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT
No. 264.
For the Week ending January 22, 1881.
Price 10 cents. For sale by all newsdealers.

PHARAOH'S SERPENTS—ARE THEY DANGEROUS TOYS?

Serpents' eggs, or, as they were at first called, "Pharaoh's serpents," are much more easily produced than their extraordinary properties and the high-toned sound of the name, mercurous sulphocyanide or sulphocyanide of mercury, would indicate. For this mercurous sulphocyanide is a very fine, white, soft-feeling powder, and when wet up with weak gum water may be kneaded or moulded into any desired form. In early days the standard form was a cone about one-third of an inch high, and the conical masses, after drying, were covered with tin foil. Of late the pill form is the fashion.

But the mercurous sulphocyanide is not a commercial article, and perhaps there are not in all the world half a dozen stores where it is kept in stock; probably its only industrial application is to be found in the serpent manufacture. Moreover the raw materials, which, by a direct and simple process of mixture, result in the production of the mercurous sulphocyanide, are not commercial; these materials are sulphocyanide of potassium and nitrate of mercury. When solutions of these salts are mixed, the mercury and potassium change places, and immediately there result mercurous sulphocyanide, the serpent constituent, which precipitates, and nitrate of potash (saltpeter), which remains in solution. The foregoing is all the instruction which a chemist should require to understand and execute successfully the serpent making process; he should know what materials to start with and how to manage them. For tyros and others who may be concerned to know it, we give the complete process from the beginning:

Mix intimately two parts of yellow prussiate of potash with one part of sulphur; carefully melt this mixture in an iron or porcelain vessel at a gentle heat, far below redness, stirring all the time with an iron rod. The melting is successfully completed when the mass has become a tranquil liquid and will not throw up any more gas bubbles. On cooling you will have a black, brittle mass, from which water dissolves the sulphocyanide of potassium. Next dissolve mercury in diluted nitric acid, taking care that at the end of the process there shall still be undissolved mercury; you have then a solution of protonitrate of mercury. Dilute filtered solutions of the nitrate of mercury and of the sulphocyanide of potassium are to be prepared and to be mixed by pouring the former into the latter as long as a precipitate is produced. This precipitate is the mercurous sulphocyanide (the serpent substance), which is to be collected, washed, dried, etc.

When these marvelous serpent toys were invented, about twenty years ago, they were admired and talked about all over the world; there was a popular enthusiasm over them comparable in earnestness to that which sixty years ago greeted Sir David Brewster's kaleidoscope. But to-day it is the temper of the people to scotch Pharaoh's serpents, while Sir David's toy is as popular as ever. The fact is, the kaleidoscope is one of the joys forever, and the serpents belong to the breed of the venomous. The venom of Pharaoh's serpents is mercury.

Pharaoh's serpents at first were made and sold on a great scale, and it was not long before their vicious traits were manifested all over the country. At one of the serpent factories in this city, where the work was performed mostly by girls, it was found that about one in ten would be prostrated on the first day at the factory, and that a majority of the employes would be visibly injured within the first week of their stay by mercurial poisoning. Among the curious cases which turned up was that of an employe who continued in the business from first to last in the most robust health; he seemed to thrive on the mercurous sulphocynide which he was continually, one way and another, taking in, and thus to elucidate the old adage of meat and poison. We have known a person who could not with impunity touch mercury or remain in a room where a small surface of mercury was exposed to the air. When the eggs are ignited one of the products of the combustion is mercury in vapor.

We are constrained, therefore, emphatically although regretfully, to condemn Pharaoh's serpents as dangerous toys. Perhaps they may be permitted among the brilliant experiments of the chemical lecture, but for children to play with—not at all.

These remarks are suggested on reading a letter from an esteemed correspondent who thinks that the serpents may not be dangerous. He says he has made hundreds of them and has suffered no evil. If all the dangerous things were fatal, there would be no survivors to sound the warning.

ICE ROADS AND RAILWAYS ON ICE.

As soon as the St. Lawrence River is firmly frozen about Montreal the work of constructing winter ice roads is begun to connect the city with the mainland. As described in the local papers the method of making the roads is simple, and in frosty weather the work is easy. The track is first marked out by lines of small bushes; then the rough surface of the packice is hewn smooth and the fragments cemented by pouring on water. There are two roads to Longueuil, one rounding the corner of Ile Ronde and the other passing the eastern end of St. Helen's Island. The city pays half the cost of maintaining the lower road, while it constructs and maintains one-half of the upper road. The Laprairie road, which passes beneath the piers of Victoria Bridge, is located and constructed by the Laprairie authorities, the city of Montreal paying one-half the cost. The St. Lambert road is constructed and maintained jointly by the

city and St. Lambert, each paying one-half the cost of maintenance. The iron road or the ice bridge railways between Hochelaga and Longueuil, is a much more difficult and expensive affair. The surface has to be carefully leveled, then the sleepers are securely frozen in, and the track laid in the usual way. Last winter the Northern Pacific Railway used an ice road across the Missouri River for construction trains, transporting in this way a vast amount of material for the road beyond. During the present season the Russians have adopted the same plan for a freight railway on ice between Oranienbaum and Cronstadt.

ELECTRIC ILLUMINATION AT MENLO PARK

To subject his system of electric lighting by incandescence to the crucial test of actual outdoor use on a large scale, Mr. Edison has set up at Menlo Park a plant embracing five hundred lamps distributed over an area one mile long and half a mile wide. His laboratory stands upon a gentle eminence from which the lines of lamps extend half a mile to right and left, the entire area under illumination being, from the slope of the land, easily visible from the central station.

The lamps are in a circuit comprising seven miles and three-quarters of wire, and are supplied by a current generated by nine dynamo-electric machines driven by one engine. The lamps are of sixteen candle-power, equal to an ordinary street gaslight, and are absolutely steady, shining with a mild and serene effulgence, which is exceedingly pleasing to the eye. The division of the current is complete and economical, and the entire system of lights can be turned up or down, off or on, as easily as one can regulate the flow of gas in an ordinary burner.

Simply as an exhibition of perfect illumination under perfect control, covering a vast area, this array of lamps presents a most remarkable and delightful sight, and is alone well worthy of a trip to Menlo Park. As a demonstration of the perfected working of a great and novel system of illumination, sure to become in a little while a potent contributor to the comfort and economy of city life, it is a spectacle which cannot fail to impress powerfully the mind of any observer.

The lamps have been but slightly modified in form and construction, since they were figured and described some months ago in this paper. In principle they are unchanged. The present appearance of the lamps is clearly shown on our front page; the plan of suspending the lamps as in the chandelier, serves particularly well in elevated lights, since the shadow of the fixture is thereby avoided. Three sizes of lamps are made, one-third, one-half, and full size, or equivalent to 5½, 8, and 16 candles respectively. Unlike other electric lamps the incandescent lamp requires no attention; there are no carbons to change, and need not be touched save to keep the outer globe free from dust, during the entire period of its existence, which covers several months. In case a lamp is broken by accident of internal defect, another can be put in its place as easily as a candle can be set in its socket. The suspension of one lamp has no effect whatever on the others in the circuit. According to the latest tests, to supply the current for one lamp of 16 candle power, for one hour, requires the consumption of two-fifths of a pound of coal. Still greater economy of power is expected by the use of the large generator now approaching completion.

THE TEHUANTEPEC SHIP RAILWAY.

The prompt and cordial acceptance by the Mexican people of the feasibility and the entire practicableness of Mr. Eads' plan of a ship railway across the Isthmus of Tehuantepec is probably without parallel in the history of nations, as it is in the history of great undertakings. Scarcely less remarkable is the generous spirit with which the Mexican Government has welcomed the enterprise. The liberal concession which it has granted to Mr. Eads gives him the right to construct a ship railway on the plan illustrated and described in the SCIENTIFIC AMERICAN of Nov. 13, 1880, on any line that he may select, the work to be begun within two years from the date of the grant and completed within twelve years. He is to have a right of way across the Isthmus half a mile in width, with an additional half mile of width where stations are required; also a subsidy equal to 1,000,000 acres of public land, to be located on the Isthmus or elsewhere, toward the construction of a harbor on the Pacific Ocean.

The grant gives, further, the right to acquire the Tehuantepec Railway, now building, and to improve such rivers and harbors as may be of use to the ship railway service, collecting tonnage dues from vessels entering them. Liberal tariff charges are allowed for transporting ships over the road and for auxiliary service; and the enterprise is exempted from all export and import duties on money and material during the entire period of the grant, ninety-nine years. At the end of this time the government is to take possession of the works, paying therefor two-thirds of their value. Permission is given for the United States Government to lend its aid, thus making our Government practically a partner with Mexico in carrying out the enterprise.

The length of the Tehuantepec route is 112 miles; the estimated cost of the proposed road is $75,000,000. The great advantage of the route over the Panama route—aside from its superior healthfulness—lies in the saving of distance for American shipping and the avoidance of the unfavorable winds and calms of the lower latitudes, the Panama route lying 1,200 miles further south. Ships from New York to San Francisco would save 1,500 miles by way of Tehuantepec; while 2,300 miles are saved over Panama between New Orleans and California.

At Mr. Eads' request an expedition comprising about fifty individuals—engineers, assistants, laborers, and soldiers—to assist him in making a survey of the Isthmus to determine the most practical route for the ship railway, has been prepared by the Mexican Government and sent to the Isthmus. This commission is under the direction of the eminent civil engineer, Francesco De Garay, who is in charge of the drainage of the Valley of Mexico, and who was commissioned to represent the Mexican Government at the Paris Canal Convention. He is directed by the government to assist the engineers of Captain Eads in the instrumental survey of such routes as he may designate. Messrs. Williams and Corthell will direct the survey during the absence of Capt. Eads, who has returned to Washington. It is thought that a large saving in the length of the railway can be made by taking advantage of the Coatzacoalcos River and its tributary, the Usuparapa.

SHOULD A BABY BE FAT?

While there is a measure of truth in the assertion that fat babies are not necessarily healthy, the following much quoted extract from a physician's letter to a Boston paper is likely to do mischief by its extravagant condemnation of fat. Speaking of fatty degeneration the physician says:

"Most infants do become thus diseased before they are three months old. This stops the growth and leaves the poor deceived parents nothing but increase in weight to boast of; and when the poor little victim to his own greed and his parents' folly gets to the end of his tether he melts away like butter in a hot oven, and then it is seen how poor (in flesh) he has been all the time. Few comprehend the broad difference between flesh and fat. The first is lean meat—muscle—the result of growth; while fat—I don't care how hard and solid it may be—is the product or accumulation of unexcretial excess. This is why no one bets a dollar on a fat horse or a fat man—they are 'soft' and 'can't stay.' It is every whit as true of a fat baby. The only wonder is that any infant lives sixty days from birth. Fed before birth but three times a day, he is after birth subjected to ten or twenty meals in the twenty-four hours. Before birth he grows at the rate of about ten pounds per year, after birth he is permitted to fat at the rate of fifty pounds per year until chronic dyspepsia or some acute disease interferes. Feel of a kitten, calf, colt, or a young robin—they are and remain while growing but little more than skin and bones and fur or feathers, because unable to get enough to fatten them, and they never die—rarely have any sort of disease. Children are never fairly 'out of the woods' until they reach the lean age and have pipe-stem legs and arms, with no rolls of fatty tissue anywhere about them. Could they be kept so from birth and not permitted to over-indulge, so that their appetites would always be reliable for plain food, they would have no infantile diseases to enrich our pockets."

Why should the kitten, the colt, or the young robin be taken as a model of infantile health, rather than the puppy, the bear cub, the pig, or the young pigeon?

It is the nature of some young animals to be lean and healthy; of others to be fat and healthy; and there is as marked a difference in the natural tendency of young children. Infants of the same parentage and fed at the same breast will differ in this respect, and both be healthy. Fat laid on at the rate of "fifty pounds a year" is quite another matter, and one not liable, we take it, to be a common cause of anxiety. Injudicious feeding is more apt to show itself in lack of fat, and lack of proper muscular tissue as well. That sort of leanness is much too common in young humanity.

The Value of Weather Prophecies.

Professor Cleveland Abbe, of the Signal Service, was recently interviewed by a Washington correspondent of the Boston *Herald*, who asked the following pertinent questions:

Has the weather bureau paid any official attention to Mr. Vennor's prognostications? A.—To test the accuracy of his work, we have occasionally compared his predictions as published in the newspapers, which accounts, of course, contain telegraphic and typographical errors for which Vennor is not responsible, with the real facts. We find that one-quarter of his predictions are verified, if they are intended for the St. Lawrence valley. If they are meant for this locality, as those who would give him credit for predicting the recent storm here must believe, then not ten per centum of his prophecies come true. In view of his continued failures, one or two brilliant successes would not justify us in adopting his system of foretelling the weather.

Q.—Upon what are his methods of announcing the weather based? A.—He keeps his system a secret to himself. There are, however, a few ways in which a comparatively truthful guess can be made at the weather months ahead. The first is by observing the average weather during each month for a long period. If we find that, for several months, the average has been wet or cold, it may be predicted that, during the immediate succeeding months, the weather will be the reverse, that is, dry or warm. Then we can get at the matter in another way. When January, February, and March have certain characteristics, the latter part of the year, October, November, and December, will have corresponding characteristics. Thus the weather may be foretold, in a general sense, some months ahead. But no man in the world has ever devised a plan which will foretell special storms on certain days, or which will offer a genuine prediction for a long period in advance. We are sometimes asked to give the weather several days in advance in the case of festival occasions. Under favorable conditions we can do this, with a very good chance of successful prediction. For instance: The chances are that the last few days of August will be clear, because the records show that this is the case five times to one. This, of course, relates to a particular locality, and cannot be made to cover the whole country. I suppose all Mr. Vennor's predictions are made by these methods.

Q.—Have you watched the weather predictions of the New York *Herald*, which are cabled to Europe? A.—Yes, sir. During the first months of that service I very thoroughly and carefully compared their predictions with the weather in Europe, and am satisfied that there is not more than 17 per centum of verifications in the predictions made by the *Herald* bureau. There are about 25 per centum of cases that might be considered doubtful, making a little more than 40 per centum of predictions which come near the truth. A perfectly independent investigation was made by the director of the London meteorological office, and he arrived at precisely the same figure, 41 per centum. This is really no better than could be done by guesswork.

ELECTRIC LIGHT GOOD FOR THE EYES.

When the electric light first began to be used in our shops, factories, and places of amusement, it was confidently asserted by its opponents that so dazzling a light must be injurious to the eye. The objection seemed plausible at least, although the light when diffused seemed to have the quality of bright moonlight, which is the reverse of irritating. People would persist in looking at the source of the light, and as the early lamps were far from steady, the observer's eyes suffered both from the intensity of the light and the sudden and large variations in the quantity of it. It appears, however, from the experiments recently made by Professor Cohn, of Breslau, whose name is so familiar in connection with the investigation of color blindness and other optical defects, that our eyes will be benefited rather than hurt by the new method of lighting, and it is obvious that with incandescent electric lighting the advantages will be still more marked.

While testing the influence of electric light on visual perception and the sense of color, Dr. Cohn proved, he thinks, that letters, spots, and colors were perceived at a much greater distance under electric illumination than by gas light, or even daylight. Compared with daylight, the electric light increased the sensation of yellow sixtyfold, red sixfold, and green and blue about twofold. Eyes that in daylight or gaslight could perceive and distinguish colors only with difficulty were much aided by the electric light, and the visual perception was much strengthened. In all cases of distant signaling, Dr. Cohn believes that the electric light will prove exceedingly and especially useful.

William A. Lighthall.

William A. Lighthall, the oldest designer and builder of marine engines in this country, and inventor of the widely used surface condenser for ocean steamers, died in Brooklyn, N. Y., January 4. Mr. Lighthall's connection with steam engineering began with the engines of the Claremont, the first steamer plying on the Hudson River; and for many years he was engaged as superintendent and constructing engineer for river and ocean lines of steamers. He was State Inspector-General of steamboat hulls and boilers in California for three years. From 1847 to 1862 he was inspector of steamboats and boilers in this State. Of late years he has been engaged in the manufacture of surface condensers.

Volcanic Ash for Phylloxera.

It is reported that a Neapolitan gentleman residing at the foot of Mount Vesuvius has cleared his vineyard of phylloxera by the use of volcanic ashes. Seeing that the soil of the country about Vesuvius is largely composed of volcanic ash, it is hard to reconcile the existence of the vine pest there with the alleged inability of the insects to endure its presence.

Charles B. Stewart.

The eminent civil engineer, General Charles B. Stewart, died in Cleveland, Ohio, January 4. General Stewart was engaged in the construction of the Philadelphia, Wilmington, and Baltimore Railroad, one of the first railroads in the country built for passenger service. Subsequently he constructed the Brooklyn dry docks, displaying therein an ability which secured his appointment as Engineer in Chief of the U. S. Navy. His volumes on naval architecture, the construction of dry docks, etc., attracted wide attention at home and abroad, and gained him much distinction at the hands of foreign authorities. He was for one term State engineer of New York, and deserves much, if not most of the credit for the first Niagara suspension bridge. His title was gained during the late war, in command of a regiment and afterwards a brigade of engineers.

BROKEN DIKES IN HOLLAND.—A break in the embankment of the river Maas, between Nieukuik and Vlymen, Holland, December 29, resulted in the submergence of eighteen villages. The whole country called the land of Heusden and Altena was inundated.

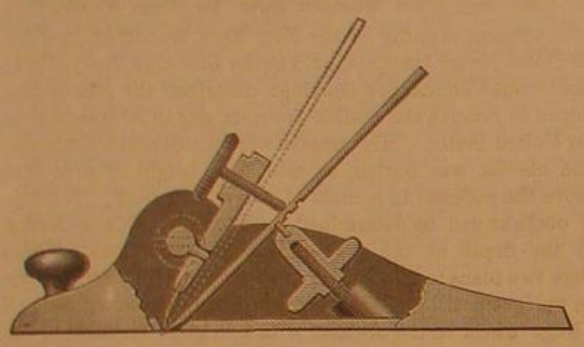
Wormwood as an Insectifuge.

In a communication to the French Academy (*Comptes Rendus*, p. 607), M. Poirot attributes to the wormwood (*Artemisia absinthium*) extraordinary properties as an insectifuge. He states that among the plants of this species that cover the vast plains of North America, he has never seen flies, ants, or any other kinds of insects; and to these he adds worms, scorpions, rattlesnakes, and other serpents. He proposes to use this property in the extinction of the phylloxera, as he believes this pest would not be able to go through the necessary metamorphoses in a soil manured with the leaves and stalks of the plant.

IMPROVED BENCH-PLANE.

The engraving shows a device by which the knife or "iron" of the plane is adjusted to various inclinations and secured in any position to suit the various degrees of hardness and grain of the different kinds of wood on which it may be used. The cap or back iron is adjusted to suit the required angle of the knife, and at the same time the back iron serves the double purpose of both holder and back-iron or cap as ordinarily used.

In planing soft wood the plane will be adjusted as shown in the engraving, but when it is desired to use it on hard wood, the thumb-screw above the iron is retracted, and the nut below the iron is unscrewed from the threaded stud until the iron touches the cap as shown in dotted lines, or the iron may be placed in any intermediate position. The nut upon which the back of the plane iron rests carries an eccentric pin which engages one of three or four slots in the back of the iron, and serves to regulate the distance the iron projects from the face of the plane.



STEERS' BENCH-PLANE.

A shaft extending across the plane has a pin which projects into a hole in the cap; by turning this shaft the cap is moved in one direction or the other as may be required.

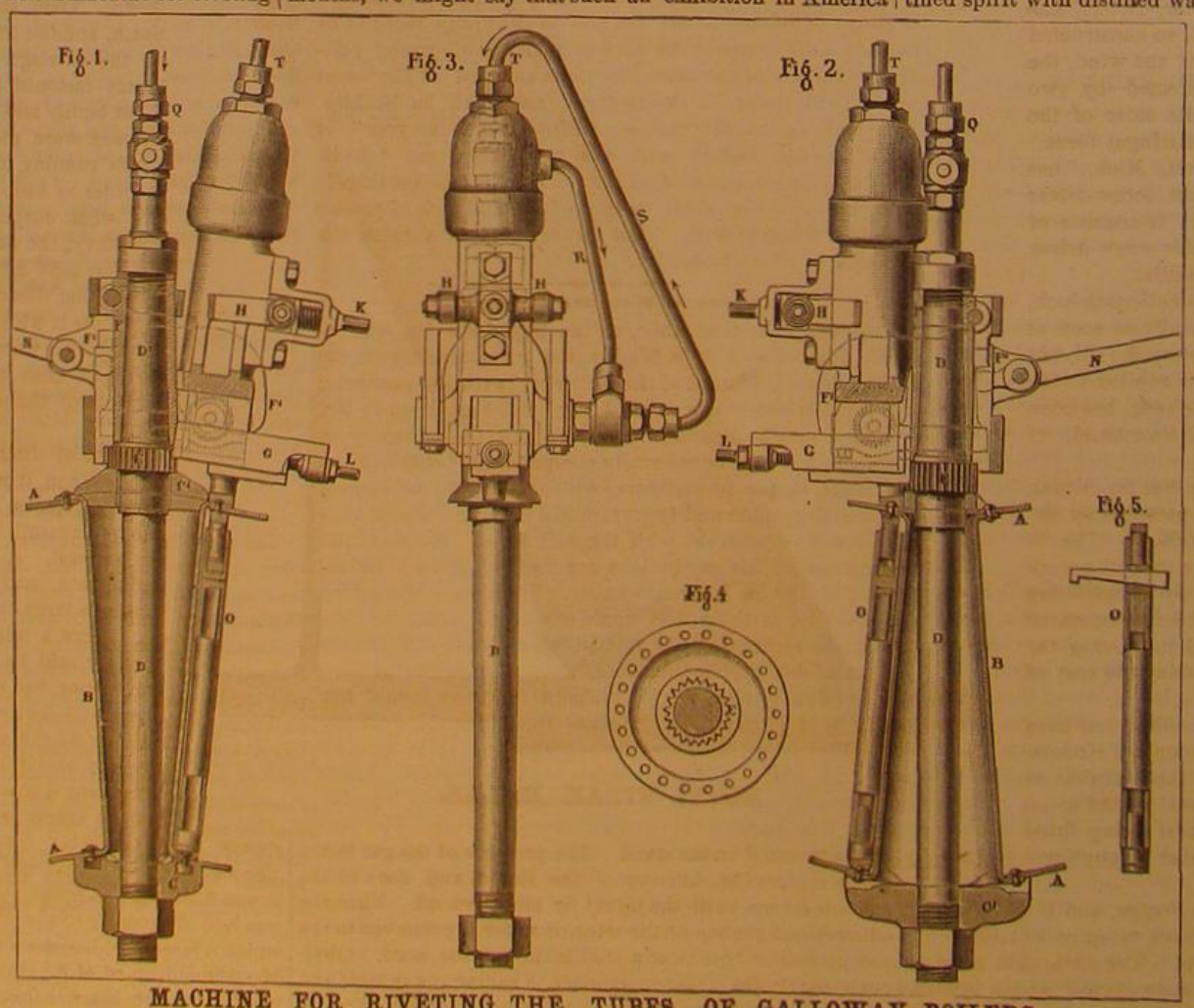
When all of the parts are in the required position they are made fast by turning the thumb-screw that bears upon the back of the iron.

This invention has been patented by Mr. William Steers, of Sherbrooke, Canada.

MACHINE FOR RIVETING THE TUBES OF GALLOWAY BOILERS.

Messrs. Galloway & Beckwith, of Manchester, England, have constructed a simple and effective machine for riveting the conical tubes of the Galloway boiler.

In the engravings, from *Annales Industrielles*, the walls of the boiler are indicated by A, and the tubes to be riveted thereto by B. Through the cast iron blocks, C and C', at the ends of the tube, the shaft, D, passes, held at the top by the gear wheel, E, at the bottom by a nut. The conical extension of the shaft, D', is surrounded by a cast iron sleeve. By the lever, N, the sleeve can be locked in any desired position. A hydraulic riveter is pivoted between the jaws, F and F', at the lower end of the sleeve, the upper end of the riveter being held by the rods, H, pivoted at the upper end of the sleeve. The inclination of the riveter can be varied at will by means of the screw, K. Since the die must be adjusted to the diameter of the tube to be riveted it is not attached to the piston, but slides in the box, G, and is held in any desired position by the screw, L. The die rest, O, carries a die at each end, and is placed in proper position by a workman within the boiler, the lower die being set over a rivet at the bottom of the tube, and the upper so as to hold the head of a rivet to be completed. The water reaches the piston, J, after passing through the rotating joint, Q, and the tubes, R and S.



MACHINE FOR RIVETING THE TUBES OF GALLOWAY BOILERS.

TOBACCO-LEAF CUTTING KNIFE.

The principal objection to the ordinary cigarmaker's knife is that after using it for a short time a gummy substance collects on the blade near its cutting edge, and unless this is frequently removed, the wrapper-leaf, while being trimmed, is liable to adhere to the blade, and the leaf is often torn in cutting, and rendered useless as a wrapper. The common way of removing this gum is by drawing the blade horizontally between the lips. This method is not only inconvenient and unpleasant, but its necessarily frequent repetition is a great waste of time and no doubt injurious to the health.

TOBACCO-LEAF CUTTING KNIFE.

The invention consists of the ordinary cigarmaker's knife-blade, attached to a hollow metallic handle closed at the end by a movable cap; the handle and a small tube extends from the handle along the back of the blade to within a short distance of the end. Near the end of the tube there is a small opening on each side of the blade.

The handle is filled with water and then closed by the cap The simple motion of the knife, when in the act of cutting, will force sufficient water from the small perforations in the tube to keep the blade wet, and thus prevent the accumulation of sufficient gum to interfere with the cutting. The blade in this manner is kept in order as long as any water remains in the handle.

This invention was lately patented by Mr. S. M. Dougherty, of Lancaster, Pa.

Manufacture of Wrapping Paper.

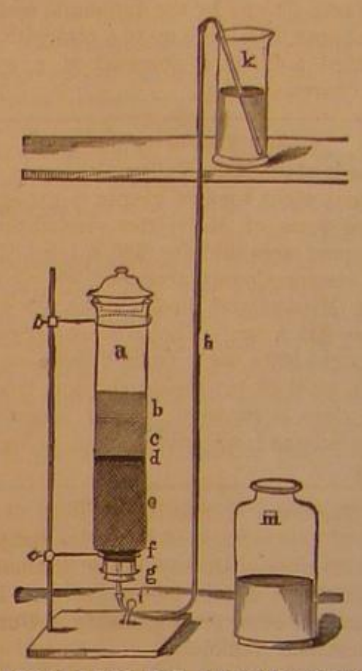
Nearly three thousand tons of wrapping paper were made in the month of October by the fifty-one mills included in the report of the Western Wrapping Paper Manufacturers' Association—an increase of one hundred and sixty-eight tons over the previous month's work. The amount on hand at the end of the month, however, was *less* than that of the month preceding—a fact which shows a healthy and active trade.

Electric Exhibition in New York.

The Operator, a paper devoted to telegraphic matters, suggests to American scientists, in view of the forthcoming exhibition of electricity in Paris, that arrangements be made for a similar exhibition in this country, at an early day, subsequent to the Paris Exhibition. America has, long ago, taken the lead in electrical research and invention, and such an exhibition in this city, the metropolis where Morse lived and died, or in Philadelphia, the home and final resting place of the immortal Ben Franklin, would be peculiarly appropriate, and, we believe, profitable. The quadruplex, the telephone, the phonograph, the microphone, and the photophone have all been invented, or have come into use, since the Centennial Exhibition, only four years ago, and, with the wonderful possibilities of even the next twelve months, we might say that such an exhibition in America would be not only a patriotic expedient, but an absolute necessity for the proper appreciation of the progress of electrical science.

IMPROVED APPARATUS FOR UPWARD PERCOLATION.

Mr. William Elborne, in a paper entitled "The Recovery of Residual Tinctures from Marcs by Upward Displacement with Water," in pointing out the various processes heretofore proposed for the preparation of tinctures, draws attention to the objections which have been raised against the displacement of the residual tincture in the marc by pouring water upon it. He says: "It will be convenient to allude to these objections, as the result will show that they tend favorably in support of the process which I am about to bring forward: First, the specific gravity of water being higher than that of rectified or proof spirit, it naturally permeates down into the spirit, which at the same time has a tendency to rise into the water, thus materially assisting the diffusion or mixing of the two liquids; secondly, vegetable tissues, possessing a greater affinity for water than for spirit, the latter is readily liberated from them and rendered free to rise in the water. Having mentioned the disadvantages of this process, I arrive at that which forms the leading feature of this paper, namely, upward displacement or the removal of the residual tincture retained in a marc by means of water (the heavier liquid) rising from below.



ELBORNE'S APPARATUS FOR UPWARD DISPLACEMENT.

Working on this principle, the objections above mentioned are inapplicable, and the results are fairly satisfactory. One impediment, however, is the slight diffusion which takes place at the line of contact, but this may be partially remedied by using a modification of the menstruum. Of the group of tinctures prepared by maceration and percolation, the following proof spirit tinctures were made: Tr. aurantii, calumbæ, cinchonæ, cinnamomi, lupuli, rhei; and with rectified spirit: Tr. aconiti, and zingiberis (fortior). The quantity prepared of each was one pint, and in those made with proof spirit, spec. grav. 0·920, I used spirit having the spec. grav. 0·915, made by diluting the requisite quantity of rectified spirit with distilled water to 19 ounces instead of 20, and adding 2½ drachms extra of rectified spirit, thus allowing for the contraction of volumes, and for use of the mixture immediately. My mode of procedure is to powder the ingredients and macerate them with the whole of the spirit, spec. grav. 0·915, for the specified time with occasional agitation; the supernatant liquid is then drawn off, the dregs stirred up and transferred to a cylindrical percolator, and allowed to drop until the liquid passes clear and bright; the receiver is then attached, and both the turbid and supernatant liquids returned to the percolator. Instead of tying a piece of muslin over the bottom of the percolator, as is usually done, a cork is inserted with a hole bored through the center capable of admitting a piece of ordinary glass tube, above which is put an inch layer of coarsely pounded glass to prevent the orifice becoming choked. Percolation being complete, another half inch layer of glass is placed on the top of the marc to prevent the floating of solid particles. Having removed the receiver and supported the percolator on a retort stand, the open end of a piece of glass tube two inches long is inserted in the cork, the other end of the tube being previously drawn out in the flame so as to leave only a capillary opening. To this end

is attached about a yard of India-rubber tubing communicating with a vessel placed above, containing distilled water, the pressure of a column of water being thus obtained. The India-rubber tube being filled with water and adjusted to the percolator, the wire clamp attached to the lower portion of the tube is removed, when a slow and steady flow of water commences; after the lapse of an hour and a half, sufficient displacement will have been effected, the water having risen considerably above the marc, and with it will have been removed the retained tincture, which forms a dense stratum upon its surface. On dipping a glass rod into this upper stratum and applying it to a flame, the displaced tincture burns nearly as readily as the percolated portion, indicating its comparative strength of spirit. Nevertheless, diffusion will have taken place to a slight extent, and is perceptible by the gradual shading off of the highly colored tincture into the water beneath it. To finish off the tincture, its measure was brought up to 19½ ounces by the addition of the requisite quantity of surface liquid from the percolator, the product filtered, and made up to a pint with proof spirit. Thus having measured the product of percolation, I know exactly how much surface liquid to draw off to bring the measure up to 19½ ounces, which is done by means of a glass siphon, and having mixed the two products, filtered by the automatic method through a thin 3-inch paper, and made up to a pint with proof spirit, I have produced a tincture prepared at a comparatively small loss.—*Pharm. Journal.*

Large Yields of Grapes.

The vineyards of the Napa Valley, California, averaged the past year about eight tons of grapes to the acre. In one instance three acres of Malvoisies yielded ten tons to the acre. The grapes were sold for $25 a ton. Twenty-eight acres in San Joaquin County produced 300 tons of grapes, of two sorts, Mission and Black Prince, the average price of which was $27 a ton. Choice grapes grown on mountain sides brought $30 a ton. In both these cases the vines were old. A yield of ten tons to the acre from three-year old Sultana vines is reported in one instance in Solano County. The Sultana is a seedless grape, in high repute for raisin-making.

ANOTHER BRUSSELS EXHIBITION.—It is stated that in consequence of the great success of the Belgian National Exhibition, two projects are now under discussion—one for holding at Brussels in 1883 or 1884 a Universal International Exhibition, and the other for organizing a Universal International Educational Exhibition.

NOVEL STEAM BOILER.

The special feature of the new boiler shown in the accompanying engraving consists in the transverse water tube in the fire box. Its obvious effect is to aid materially the raising of steam of high pressure in a short time. The boiler may be set vertical or inclined, the latter position being preferred This boiler is the invention of H. Berchtold, of Zurich, Switzerland. The illustration is from the *Allgemeine Zeitschrift für Textil-Industrie.*

NOVEL STEAM BOILER.

MECHANICAL INVENTIONS.

Mr. John F. Garatt, of Spencer, N. Y., has patented an improved windmill, so constructed as to adjust itself to the force of the wind, the automatic adjustment being effected by two weights at diametrically opposite sides of the wheel which are acted on by centrifugal force.

Mr. Gavin Telfer, of Detroit, Mich., has patented a combined hammer and screw-driver which is simple and convenient. It consists of a hammer containing an adjustable screw-driver in the lower end of its hollow handle.

An improved sash lift and automatic sash lock, which locks the sash automatically as soon as the same has been lowered to rest on the sill, but unlocks it as soon as pressure is applied to the lift for the purpose of raising the sash, has been patented by Mr. William W. Sweetland, of Edwardsburg, Mich.

An automatic attachment to lathes for cutting rubber and other rings has been patented by Mr. Joseph T. Ridgway, of Trenton, N. J. The object of this invention is to make the lathe work more quickly and accurately by substituting automatic mechanism for mechanism operated by hand, thereby increasing and improving the product of the lathe and diminishing the cost of the product.

An improved water and steam wheel has been patented by Mr. Thomas R. Simmons, of Houma, La. The inventor uses a wheel that consists of a hub provided with wings that extend to an outer inclosing cylinder, the wheel being fitted on a shaft contained in a chamber through which the fluid passes.

Messrs. T. H. Scott, A. G. De Pontee, and H. E. Wyman, of Crown Point Center, N. Y., have patented a machine for cutting wood fiber for paper pulp. The invention consists in a novel knife and the combination thereof with a revolving head for cutting wood fiber to be used in making paper pulp.

An improved electric alarm, which is designed to be set off to give a continuous warning by the breaking of an electric circuit, has been patented by Mr. Lambert F. Fouts, of Greenfield, Iowa.

BOTTLE COCK FOR EFFERVESCING LIQUIDS.

In using aerated water, champagne, or other effervescing liquids, especially in sick rooms where small quantities are

IMPROVED BOTTLE COCK FOR EFFERVESCING LIQUIDS.

required in frequently repeated doses, it is undesirable to open a fresh bottle every time, and quite impossible to preserve for any length of time the briskness of an opened bottle. To meet such cases the simple apparatus shown in the annexed engraving has been devised. It consists of a hollow corkscrew mounted upon a little stand, and so arranged that the outlet may be opened by a slight pressure on a lever. The corkscrew is passed through the cork and the bottle inverted on the stand. The pressure of the gas in the bottle insures the delivery of the liquid, and none of the gas can escape until the liquid is all drawn off. Thus the effervescent quality of the wine or water is preserved to the end no matter how slowly the liquid may be used. Obviously the device is also serviceable in saving the trouble and waste incident to the common method of uncorking bottled liquids of this character.

RECENT INVENTIONS.

Mr. William C. Beattie, of Taunton, Mass., has patented an improvement in butter dishes, which is applicable to all kinds of analogous covered dishes, such as pickle casters, jewel cases, sugar dishes, baking dishes, etc. The object of the invention is to provide a neat and tasteful means for raising and suspending the cover in elevated position above the dish.

In an improved boot heel, patented by Messrs. Riley D. Plunkett and Jason P. Rollins, of Little Rock, Ark., the heel is made detachable and attachable. Both the sole and heel have heel plates, which connect by dovetail tongue and groove, and are maintained in mutual engagement by a single screw.

An improved gatherer and ruffler for sewing machines has been patented by Mr. James B. Farrar, of Wilmington, N. C. It gathers a piece of fabric either at its edges or throughout its entire surface, or will gather or shirr a piece of fabric on a ground work, or gather one piece of fabric to another, and at the same time attach a ribbon, tape, or braid, at the seam, all in a single operation.

Egyptian Obelisks.

There are thirty of them at the present time scattered over Europe. Rome has eleven, four of which are higher than our New York obelisk. The highest of the Roman obelisks, which is also the highest in Europe, stands before the Church of St. John Lateran. The obelisk in the piazza of St. Peter's is 82 feet 9 inches high. Both of these were mounted on high pedestals. The pedestal of the St. John Lateran obelisk is 44 feet high, making the entire height of obelisk and pedestal 150 feet. The pedestal of the St. Peter's obelisk is a trifle less than 50 feet high, making the whole height of the monument 132 feet 2 inches.

The Egyptian Obelisk now in New York.

At a recent meeting of the New York branch of the United States Naval Institute, held at the Brooklyn Navy Yard, Lieutenant Commander Gorringe described the means employed to remove the obelisk from its site in Alexandria to the United States. His remarks were illustrated by models. The obelisk was buried, he said, to a height of nine feet above the pedestal in a mass of *débris* and sand. The age of obelisks can be determined with considerable accuracy by the depth of the surrounding accumulations. There were two plans to choose from in removing the obelisk from its upright position. One was by securing the segment of a huge wheel to the obelisk, with two guys fastened to the shaft behind. Then the obelisk would be tilted so as to throw the weight on the guys, and excavations being carried on under the base it would slowly turn over. This was the simplest plan, but as the nature of the ground was unknown, and as rocks would very likely render the excavation difficult or impossible, the idea was adopted of mounting the obelisk like a cannon upon a kind of gun carriage. This carriage was made in Trenton and taken to Egypt in pieces. The obelisk was carefully incased in timber, and four derricks were erected. The iron plates of the trunnions, weighing six tons each, were hoisted into place on the sides of the obelisk and bolted together by bars running across, being also supported by rods running up and down. Then the carriage was placed underneath, and the trunnions just fitted into the rests on the carriage. The different parts were securely fastened by bolts, then the obelisk was lifted bodily and turned over of its own weight. Trusses were placed on each side, with steel bands running to the heel and end of the shaft, in order to keep the obelisk from breaking in two when suspended by the middle. It was top-heavy, the part above the trunnions weighing four tons more than that below, and therefore came down upon the high cradle prepared for it with a tremendous crash. Some of the timbers were broken, but special preparation had been made for this, and a kind of cushion of timbers was ready to receive the shaft.

Stacks of timbers were placed under the obelisk. When it was recumbent it was lifted by hydraulic jacks, and the timbers were taken out one by one until it was lowered to the level of the pedestal. A deep pit or canal had been dug underneath, and a huge box or caisson was in readiness large enough to float the obelisk out to sea. Here a mishap occurred which has been wrongly said to have been maliciously caused. The caisson had to go 210 feet to reach the sea. It went 20 feet and then stopped. For the remainder of the way it had to be pushed by a pressure of 120 tons inch by inch to the sea. Afterward it was found that between the ways and the cradle were several pieces of iron and stones, which probably found their way in accidentally. The sea was very rough, and once the obelisk was sunk, but it was finally towed seven miles and put in a dry dock. It was laid diagonally to the keel of the ship, in the side of which a large port had been opened. By the aid of a kind of railway formed of 6 inch channel iron and 5¼ inch cannon balls the obelisk was moved forward, being turned when half way into the ship so as to go parallel with the keel, and

it finally lay upon a bed on the very top of the keel. Then the port was closed up. The weather was good except for three days of the voyage. No danger at all was apprehended; in fact Mr. Gorringe considered that such a rigid body rather strengthened the ship.

NEW INVENTIONS.

An improvement in mowers has been patented by Mr. Peter P. Coler, of Clyman, Wis. The object of this invention is to furnish mowers so constructed that they may be readily adjusted as front cut or rear cut machines.

A vehicle spring, patented by Mr. Fred. Schelp, Jr., of Baldwin, Mo., consists in the combination with the side-bars and cross-springs of a side-bar wagon of a median longitudinal spring passing under the front and rear axles, and connected with the body by stay-rods, whereby a more elastic, easier running, and stronger spring gear is secured.

An apparently important improvement in well-boring apparatus has been patented by Mr. Edgar P. Watrous, of Moravia, N. Y. The invention relates to wells which are formed by sinking metal tubes. The tube is provided with a cutting edge at the lower extremity, and is made to penetrate the earth by rotation on its vertical axis, being fed to its work by means of a screw-feeding arrangement. The rotation is accomplished by a hollow crank joined to the top of a tube section through which water is forced, the water being discharged from the upper part of the tube section, to which is attached a small chamber and spout.

In a machine for packing bran, patented by Wm. L. Williams, of San Diego, Cal., a series of stamps are fitted within a vertical cylinder in which they are reciprocated, while at the same time the entire series is revolved on its vertical axis to pack the bran in a bag attached to the lower end of the cylinder which is open. The bran is fed to the bag through a feed-pipe obliquely joining the side of the cylinder.

By novel and very simple details of construction a reclining chair, patented by Mr. Phillip Herbold, of Galion, Ohio, may be adjusted in different positions.

An improved aerial apparatus has been patented by Mr. Frederick W. Brearey, of Maidenstone Hill, Blackheath, London, Secretary of the Aeronautical Society of Great Britain. The inventor makes use of a vessel or apparatus the body of which is long and narrow, with tapering ends, and of the greatest sectional area at or near the center of gravity, in order to present the least possible resistance to the air, and at the same time furnish suitable space for containing the motive power and other requisite machinery and also accommodation for passengers. Two or more lever arms are attached and jointed to the longitudinal body at or near the front thereof, and the said arms are vibrated by suitable power, and give motion to flexible fabric, whereby the apparatus is sustained and propelled. Mr. John F. Mackenzie, of 16 Hawley street, Boston, Mass., represents this invention in the United States.

In a speaking-tube, mouth-piece, and bell-lever patented by Mr. William R. Ostrander, of New York city, speaking-tubes and bell-levers for operating bell wires are combined in one apparatus, which effects economy in construction and convenience in use. The bell lever is pivoted on the mouth-piece, and both are secured to the wall by a single attachment.

Mr. William Winegar, of Chambersburg, Ill., has patented an invention which avoids the necessity of special supports for the wheels of grain drills, and provides that each wheel shall maintain a constant position relative to the bottom of its tooth for all changes in the position of the tooth by an automatic adjustment. He combines with the hollow drill tooth a pronged wheel attached directly to the side of the tooth and carried by the latter, which clears the drill teeth of straw or other obstructions instead of arranging such wheel between the teeth of the drill as has heretofore been done.

Correspondence.

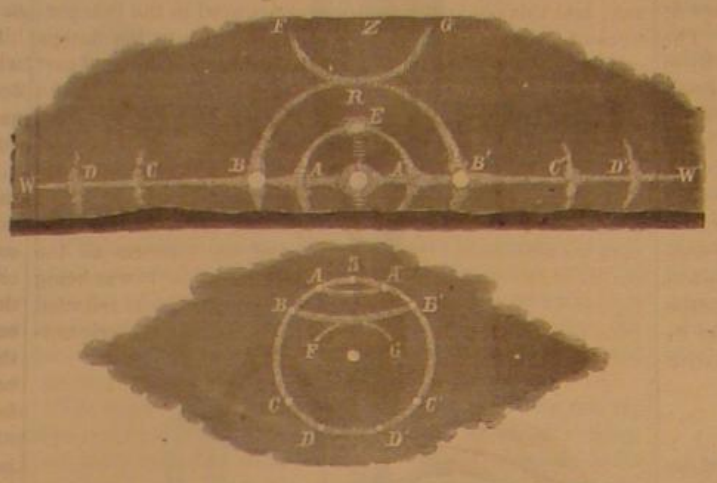
A Remarkably Brilliant Meteor, as Seen at Bloomington, Ind., December 30, from 8 o'clock to 11 o'clock.

The night of the 29th and 30th was very cold (—15° by Six's thermometer) and windy. The thermometer at 8 o'clock A.M. —6°. The sky slightly hazy.

The mock suns, A, A¹, were very large and bright, rivaling the sun in splendor, and they cast into the room well defined shadows, and their light on the wall was rather yellowish compared with the white light of the sun. These parhelia were at the intersection of the inner halo, A E A¹, and the horizontal circle, W W. This halo was very distinct, somewhat brighter at its summit, E, than on each side of it. The diameter of the inner halo, as roughly estimated from the shadows cast by the sun and one of the parhelia, was 42° or 43°. The second halo, B R B¹, was not so bright; it was surmounted by a brilliant colored arc of about 120°, with its convexity toward the sun. We could easily distinguish the red, orange, yellow, and blue colors. The center of this arc was in the zenith. The parhelia at the intersection of this halo and the horizontal circle were perfectly distinct—as bright as those usually seen on the inner halo. The parhelia, C C¹, were perfectly white and somewhat fluctuating, C¹ the brighter of the two. D and D¹ were mere blurred and faint patches of light, apparently about as far from a point diametrically opposite the sun, as A and A¹ were from the sun. The cross in the inner halo, as represented in the figure, added much to the beauty of the phenomenon. The haloes were seen till nearly noon, when they disappeared, then they appeared again between 2 and 3 o'clock P.M., nearly as splendid as in the morning, but lasting only a short time. T. A. WYLIE.

Bloomington, Ind., Dec. 30, 1880.

[In addition to the above, we have received letters and sketches from other correspondents widely separated from Mr. Wylie and from each other, who observed this splendid



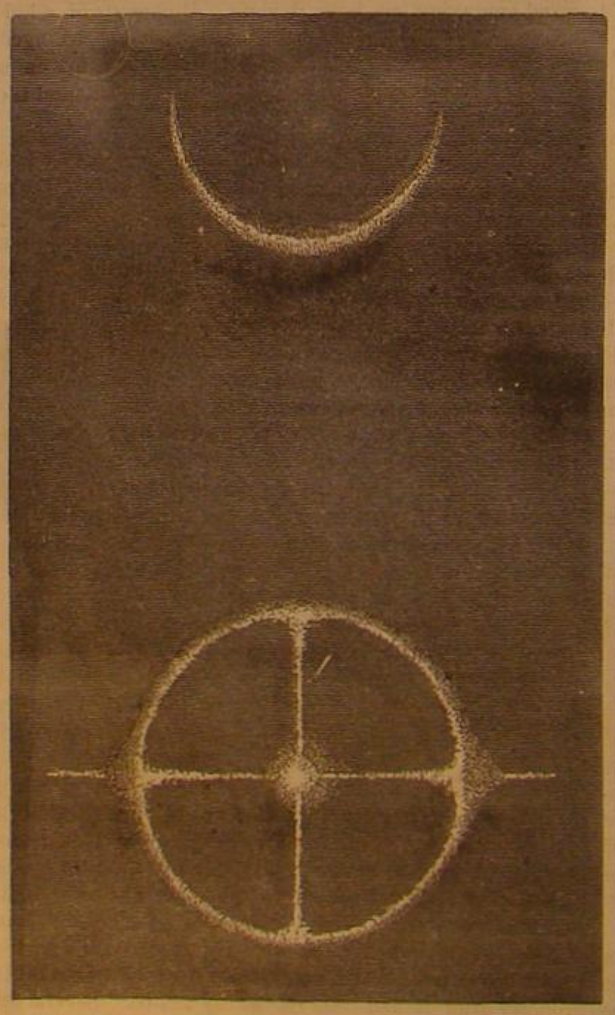
METEOR SEEN AT BLOOMINGTON, DEC. 30, 1880.

phenomenon. Mr. J. Mahr, of Suel, Minn., saw it first at noon, and says it was visible throughout the greater portion of the afternoon. Mr. C. Petri, of Hannibal, Mo., saw it. Rev. W. M. Richards, of Berlin, Wis., writes that he observed a similar phenomenon on the 26th ultimo, which surpassed anything he ever witnessed of the same nature; and to assure us of the correctness of his dates has written a second letter stating that the display observed by him should not be confounded with that seen on the 30th ultimo.]

The Parhelia.

To the Editor of the Scientific American:

On the morning of the 30th ult., at about 10 A.M., a very beautiful atmospheric phenomenon was observed at this



PARHELIA AS SEEN AT JERSEYVILLE, ILL.

place, such as I never before witnessed, or ever found wholly described in any written work on the subject. I made a sketch of it on the spot, as faithfully as possible, and herewith send you a rough though true copy thereof, the relative dimensions and distances being preserved as correctly as possible. The night preceding was intensely cold, the mercury falling to 20° below zero.

There appeared, at the hour above stated, two very brilliant mock suns intersected by a well defined, slightly iris colored, bright circle, having the sun at its center. This circle was divided into quadrants by four brilliant rays of white light, radiating apparently from the sun, two horizontally and two vertically; the horizontal rays intersecting the mock suns, and extending some distance beyond, as shown in the diagram.

The most remarkable part of this interesting phenomenon was the appearance of a brilliant inverted crescent near the zenith, subtending from cusp to cusp an angle of about 14°. The colors were disposed in prismatic order and as brilliant as those of the most beautiful rainbow I ever saw; the red outside, toward the sun; the violet inside. The mock suns were also strongly tinged with red on that side farthest from the sun.

This beautiful celestial spectacle, which almost every one turned out to see, reached its maximum brilliancy about noon, and gradually diappeared about 3 P.M.

I am aware that the crossed circle and mock suns are not new, for I remember having noticed a description of an appearance of this kind in either the SCIENTIFIC AMERICAN or its SUPPLEMENT, some years ago, but the beautiful and brilliantly colored crescent that so much enhanced the splendor of the spectacle is, *to me, new.*

I should be pleased to know whether this phenomenon was seen from other places, and whether the like has been before observed.

F. S. DAVENPORT.

Jerseyville, Ill., January 1, 1881.

Magnificent Parhelia.

To the Editor of the Scientific American:

At about 10 o'clock this forenoon quite a number of our citizens observed a very strange, magnificently grand spectacle, never before seen by any of the spectators. It consisted of two mock suns, an arc of a rainbow inverted, and a halo of wonderful beauty.

The wind last night was nearly northwest. Yesterday morning the thermometer indicated 25° below zero, and averaged 15° all day yesterday; to-day, at the time of seeing the parhelia, it indicated 2° below. The sky this morning was clear, and the air sharp and crisp, with quite a slight breeze.

The parhelia or mock suns were bright and distinct and in the usual places, namely, in the two intersections of a strong and large portion of a halo, with an imaginary circle parallel to the horizon passing through the sun. Each parhelion had its tail of a varied yellow, red, and white color, and in apposition to the true sun, that toward the east being 20 degrees long and that toward the west 15 degrees, both narrowing to a point at the remote ends.

The mock suns were quite red toward the sun, but pale or whitish at the side, as was the halo also. Still higher in the heavens was an arc of a curiously inverted rainbow about the middle of the distance from the top of the halo and the vertex. The arc was as marked and distinct in its colors as the common rainbow, yet somewhat wider.

The red color was on the convex and the blue on the concave of the arc, which seemed to make 180 degrees in length, its center being in or near the vertex. On the top of the halo was a kind of an inverted bright arc. This brilliant scene was visible for more than half an hour.

Although it is recorded that quite a number of parhelia have been seen, both in ancient and modern times, yet I can find an account of but one similar in its appearance to the one seen here to-day, from which I have copied largely in my description, as they seemed so nearly alike.

The other spoken of is found on page 329, of volume ii., of the *Family Magazine*, published in New York in 1835, by Redfield & Lindsay. It is there stated that they were seen at Lyndon, in the County of Rutland, England, at 11 o'clock in the morning on the 22d day of October, A.D., 1721, and were seen the following day, and again on the 26th.

J. IVOR MONTGOMERY.

Sandwich, Ill., December 30, 1880.

Restoring the Dead.

Professor Fort has presented the question of premature interments to the French Academy in a paper on artificial respiration. One fact he mentions is, that he was enabled to restore to life a child three years old by practicing artificial respiration on it some four hours, commencing three hours and a half after apparent death. A similar case is reported by Dr. Fournol, of Billancourt, who reanimated a nearly drowned person after four hours of artificial respiration. This person had been in the water ten minutes, and the doctor arrived one hour after asphyxia. Professor Fort advocates also the utility of artificial respiration in order to eliminate the poison from the lungs and glands. The length of time it is desirable to practice artificial respiration in any case of apparent death from asphyxia may be said to be several hours.

A Case of Leucoderma.

Dr. J. H. Thompson, of Goshen, N. Y., writing to the *Medical and Surgical Reporter*, states that there is a negro of quite advanced age living in that village, whose case gives an affirmative answer to the question, "Can the Ethiopian change his skin?" He furnishes a unique example of the rare skin affection known as *leucoderma*, or *achroma*. The transformation has been in gradual progress for several years, until, at the present date, the man, formerly of typical negro blackness, has become of fair Caucasian whiteness in at least half extent of surface. He is, as always happens in leucoderma, piebald as regards transformation. As an extraordinary specimen of a dermatological lesion the individual is a decided curiosity.

ON MAGIC MIRRORS.

BY MM. BERTIN AND DUBOSQ.

The people of the far East, the Chinese and the Japanese, in bygone times were only acquainted with metallic mirrors; and even to-day they make only these. They are made of speculum metal, of various forms and sizes, but always portable. One of the faces is polished and always slightly convex, so that its reflection gives images which are reduced in size; the other face is plane or slightly concave, and always has cast on it ornaments which are in relief. Among the many mirrors thus constructed there are a few which possess a wonderful property: when a beam of the sun's light falls upon the polished surface and is reflected on to a white screen, we see in the disk of light thus formed the image of the ornamentation which is on the back of the mirror. The Chinese have long known of these mirrors and value them highly; they call them by a name which signifies *mirrors which are permeable to the light*. We, of the West, call them *magic mirrors*.

Magic mirrors are exceedingly rare. We only find mention of them four times in the *Comptes Rendus* of the French Academy of Sciences. The first was presented to the Academy by Arago, in 1844; the second and the third were brought to the notice of the Academy in 1847 by Stanislas Julien and by Person, and the fourth was exhibited before that society in 1853 by Maillard. It is true that even so far back as 1832 Brewster gave a theory of the phenomena of magic mirrors; but his explanation was made on the basis of the description of one of these mirrors which came from Calcutta, but which Brewster had never seen. Finally, in 1864 and 1865, M. Govi read before the Academy of Turin two papers on very beautiful experiments which he had made with three magic mirrors; this brings to seven only the number of these mirrors which, up to that date, had been seen in Europe since men have begun to observe facts in a scientific manner. Therefore very few persons had seen magic mirrors till the month of last April, when an English physicist, Mr. Ayrton, professor at the Polytechnic School at Yeddo, exhibited several of these mirrors, which he had brought with him from Japan. He experimented with them, and very successfully, before a small audience in the laboratory of M. Carpentier. He then left for London, and it will probably be a long time before we again have the privilege of seeing these marvelous mirrors.

In the meantime I received a visit from M. Dybowski, my former pupil, who had returned from Japan, where for two years he had been the colleague of Professor Ayrton. He brought back with him as objects of curiosity four *temple mirrors*—that is to say, antique mirrors; these are far superior to mirrors of modern production, for the manufacture of these mirrors has been nearly abandoned by reason of the introduction of the silvered mirrors of Europe. We tried them together; three were circular, and the thinnest of them, which is a disk of 15·3 centimeters in diameter, was found to be slightly magic.

To try such a mirror we reflect a sunbeam from its polished surface on to a white cardboard, about one meter distant. But to obtain the very best effects we must illuminate the mirror with a diverging pencil of light; this pencil is made still further divergent by reflection from the mirror, because its reflecting surface is convex. We can now receive the reflected rays on a screen at a greater distance, and we at once see distinctly the magnified image of the ornamentation on the back of the mirror. These raised designs appear on the screen in white on a dark ground. The image thus made by our mirror was confused, because the mirror was not a good one; it would have been sharply defined had the mirror been properly made. I then knew of no means by which I could make it give better effects.

The means by which the mirror could have been improved were first pointed out by M. Govi in the second of his two papers to which we have referred. It is a consequence of the true theory of magic mirrors. The theory was not reached at once.

Stanislas Julien has found in the writings of a Chinese author of the twelfth century of our era an explanation of the wonderful effects of these mirrors. The author supposes that the designs in relief on the back of the mirror are reproduced by deep engraving on the front, and then a finer and more highly reflecting metal is poured into the lines of this engraving. On polishing the face of the mirror the magic effect is produced in the image by the greater reflecting power of the finer bronze.

The theory of Brewster does not differ substantially from that of the old Chinese. The polishing of the mirror effaces traces of the operation of engraving, rendering the surface the same throughout when inspected by ordinary light, but this engraving is developed when the sun's rays are reflected from the face of the mirror. But Brewster, who proposed this explanation, was not aware that this reflecting surface was really amalgamated.

This very ingenious theory was not known in France when they began to take interest in magic mirrors; if it had been it might have misled those who sought an explanation of these curious phenomena. The first French physicist, Person, who had the opportunity of experimenting with one of these mirrors, at once gave the true explanation of its action. He satisfied his own mind, by direct experiments, that the polished surface of the mirror was not regularly convex. It was so in all parts except those corresponding to the design on the back of the mirror. "The rays," says he, "reflected from the convex portions diverge and give but a feebly illuminated image; while, on the contrary, the rays reflected from the plane portions of the mirror preserve their parallelism and appear on the screen as an image by reason of their contrast with the feebler illumination of the rest of the image."

This irregularity of surface of these mirrors is brought about by the peculiar process adopted in working them, and which was explained to us by Professor Ayrton.

The mirror comes from the mould as a disk with a plane surface, and before it is polished this surface is scored in all directions with a pointed tool, and naturally it offers more resistance in the thick than in the thin parts. This operation tends to make a slightly concave surface, but the reaction of the elastic force of the plate makes this surface slightly convex; and this convexity is more pronounced in the thin portions of the plate than in those corresponding to the design on the back of the mirror. This irregularity of form of surface cannot be detected in diffused light, but it may, in the case of thin mirrors, produce the magic effect by the reflection of a very bright light, like that of the sun or of an oxyhydrogen jet. This is, indeed, the case with all badly wrought metallic mirrors; thus a plate of silver may give good reflected images, but on reflecting from it the sun's rays we will see on the image formed on a screen all the marks of the hammer which it received when it was being flattened. It is really a true magic mirror, only its reflected image is irregular and confused, while that of the magic mirror is regular like the design on its back.

THE MAGIC MIRROR.

The experiments of Govi were made to overthrow the theory of Brewster and to establish that of Person. Though these experiments are very interesting, I shall not here describe them, because they have already been extensively published in the annals of science; I will only recall the last and the most curious of his experiments, that in which he heats the back of the mirror. The thin portions should heat more rapidly than those in relief; they will become more convex, the irregularities in the form of the surface will become more pronounced, and the magic effect will be increased; it may even be thus produced in mirrors which, without such treatment, are devoid of magic properties.

When I became acquainted with the papers of M. Govi, I proposed to M. Dubosq to associate himself with me, in order, first, to repeat the experiments of the learned Italian, and then to study generally the interesting phenomena of magic mirrors, in the hope of being able eventually to reproduce them in his workshops. At first we had at our disposal only the mirror brought from Japan by M. Dybowski, and which gave confused images with the reflected solar rays. These images became very sharply defined when we had heated the back of the mirror with a gas lamp, and the mirror gave very magic effects.

We then made a mould and reproduced this mirror, not in Japanese bronze, but in ordinary gun metal. The first copy was roughly worked on the lathe, after the Japanese manner, in order to render it magical, but this was broken. The second was worked carefully on an optical grinding tool; the surface was then polished and nickel plated, but it was not magical; but it acquired this property in a high degree when it was heated, and it even retained traces of this property after it had been repeatedly heated. Several Japanese mirrors which we have procured have given analogous results.

We then engraved letters on the back of little rectangular Japanese mirrors. On heating these the letters appeared in black in the reflected image. When we cut lines around the design on the back of the mirror, heat rendered them very magical, for the design stood out framed in the black lines which bordered the figures.

Thus it is seen that heat is very efficacious in rendering mirrors magical; but it is not without its inconveniences. First of all, it injures the mirrors, which thus lose their polish, especially when they have been amalgamated; also, the mirror is often not heated equally and the images are deformed. It occurred to us that the change of curvature which was required could be obtained more uniformly by means of pressure. M. Dubosq therefore constructed a shallow cylinder of metal, closed at one end by the metallic mirror, and at the other by a flat plate of brass, having in its center a stop cock, which we could attach by means of a rubber tube to a little hand pump. This pump could be made either to condense or rarefy air. If the rubber tube was attached to the pump, arranged as a condenser, a few strokes of the piston sufficed to compress sufficiently the air in the shallow cylinder; the mirror became more and more convex, the cone of reflected ray became more and more open, and in the image on the screen the design on the back of the mirror became more and more distinct. Our Japanese mirror, when thus treated, gave very fine images, and the copy which we had made, and which gave no result as ordinarily experimented with, now became a magic mirror as perfect as any of those which Professor Ayrton had exhibited before us. A mirror in brass, nickel plated, on whose back was soldered tin plate figures, around whose borders were cut lines, became very magical by pressure, and gave the design on its back in light surrounded by dark borders.

This is what I call the *positive image*. We can also obtain the *negative image*, or the inverse of the preceding one, by rarefying the air in the shallow box. To do this we have only to attach the rubber tube to the pump arranged as an ordinary air pump. On now working the lathe the air in the shallow box is rarefied, the mirror becomes concave, the cone of the diverging reflected rays close up, the image of the design is reduced in size, changes its appearance, and becomes an image of the design on the back of the mirror; but this now shows in shade bordered with bright borders.

These experiments require an intense light. A jet of coal gas is insufficient; but the oxyhydrogen light is sufficiently intense. We intercept it with a screen perforated with a small hole, so that the diverging pencil which falls on the mirror may not spread too much. The mirror is mounted on the top of a column, so that it can be made to face in any required direction. The effects are most brilliant and the best defined when we experiment with the rays of the sun. When we expose the mirror to the beam of the porte-lumière it is generally not entirely covered by the light; in this case it is best to use a diverging beam obtained by means of a lens placed between the porte lumière and the mirror.

Thus we have seen that we can now make copies of the Japanese mirrors, some of which may be magical, but all may be rendered so by making them covers of the shallow box containing either compressed or rarefied air. This pressure box and its mirror, made in the Japanese style, certainly forms one of the most curious pieces of apparatus which is to be found in the cabinet of physics.

We shall not, however, stop here. One of these days, while our mirror is magical under the influence of pressure, we will take a cast of its surface, and then reproduce this by means of galvano-deposition. This surface will have all the irregularities of that of the magic mirror, and will produce by its reflected rays the image of a design which no longer exists on its back.—*Journal de Physique*.

Artificial Indigo.

Mr. Adolph Baeyer, of Munich, has discovered that by the action of sulphuric acid upon orthonitrophenylpropiolic acid a new product may be obtained which is capable of being converted into new coloring matters, or a dyestuff which he calls "artificial indigo."

The author says: "I take orthonitrophenylpropiolic acid, and in the cold I mix the said acid with sulphuric acid—say, for instance, with from about ten to twenty parts, by weight, of sulphuric acid of about 1·84 specific gravity to every one part, by weight, of orthonitrophenylpropiolic acid employed. In effecting the said mixture care is to be taken to avoid a considerable rise of temperature above, say, 20° Centigrade. The mixture thus obtained quickly assumes a bright yellow or orange color, and the reaction is allowed to proceed in the cold until a sample of the mixture, upon being tested for the presence of orthonitrophenylpropiolic acid by means of glucose and alkalies, no longer contains any appreciable quantity of the said acid. The sulphuric acid mixture thus produced is then submitted to the action of suitable reducing or deoxidizing agents in order to effect the conversion into artificial indigo.

"In practice I have found a great number of substances belonging to various classes of chemical compounds which act as deoxidizing agents upon the above-mentioned new product, and I may specially mention ferrous sulphate (green vitriol, copperas).

"As an example of the manner in which I prefer to conduct the aforesaid operation, I take the orange colored mixture resulting from the treatment of one part, by weight, of orthonitrophenylpropiolic acid with about from ten to twenty parts sulphuric acid, as above described, and I mix the same with a solution containing about five parts, by weight, of ferrous sulphate. The mixture is then allowed to stand at the ordinary temperature until the blue color, which it quickly assumes, is fully developed, and the dyestuff or coloring matter thus produced may be separated out of the mass by diluting the result of the operation with water, by which the new dyestuff is precipitated, and may be filtered and washed. The dyestuff is then ready for use.

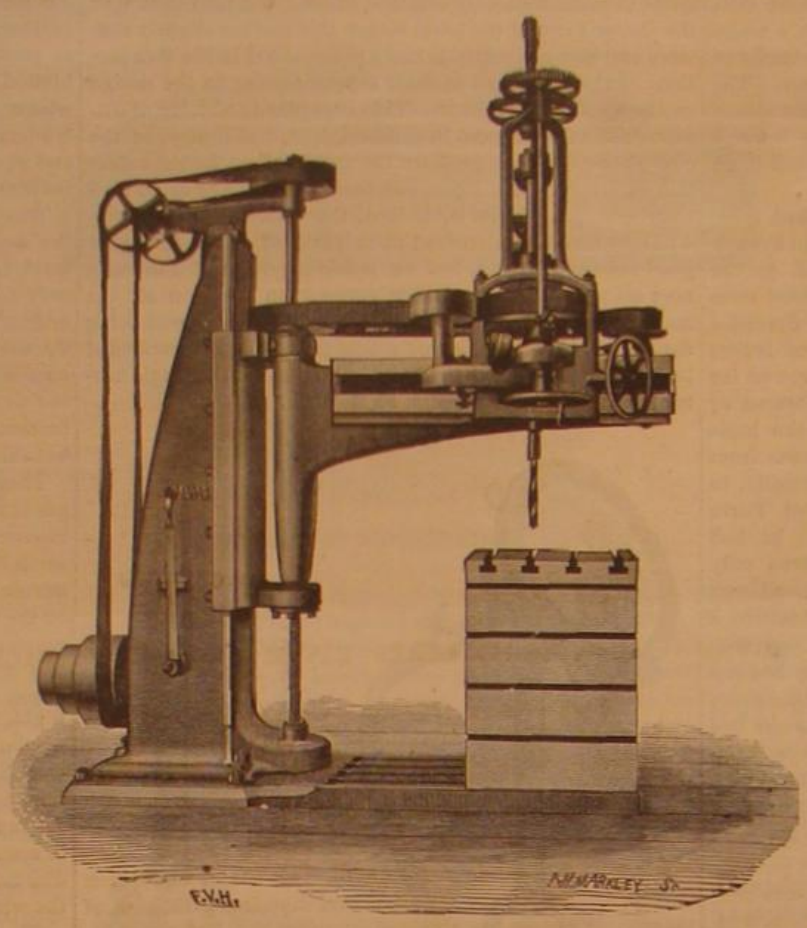
"The characteristics of my new dyestuff or coloring matter, prepared according to my above-described process, are the following: The dyestuff or coloring matter resembles in appearance vegetable indigo, and it can be used in dyeing in a manner similar to it; but it is in a great part soluble in aniline at an ordinary temperature, and also in an aqueous solution of sulphurous acid."

NEW RADIAL DRILL.

We present an engraving of a radial drilling machine recently perfected by Messrs. Wm. Sellers & Co., Philadelphia. In this machine they have utilized the plan of belt driving so successfully employed on their other forms of vertical drilling machines. They claim a gain of from 15 to 20 per cent in the amount of work done by a belted spindle machine as compared with radial drills in which the power is conveyed to the spindle through a long train of gears; and drills, too, are said to last longer, to be less likely to break, owing to the smooth motion imparted by the belt as compared to that by gearing. The swinging arm carrying the drill spindle is hung, crane fashion, to a long saddle; this saddle slides on the face of a stout upright—is, in fact, so long and so well fitted as not to need clamping when the drill is in place. This saddle and arm is raised and lowered by power, the mechanism for this purpose being operated by a hand lever at the side of upright. The saddle carrying the spindle is moved out and in on the swinging bar by a diagonal shaft operating a spiral pinion gearing into a straight rack after the manner so well known in the planing machines built by Wm. Sellers & Co. The spindle which carries the drill passes entirely through its driving sleeve, and hence has always the same length of bearing; it is also very close to the face of the swinging arm; it has a quick hand motion and an adjustable feed by power. This feed is novel and has many advantages; it is stopped and started instantly by a simple motion of a lever above the hand wheel in front of the drill spindle. The feed obtained from one of the guide pulley shafts is also adjustable through a wide range of gradations, in two series, one for small drills, and a coarser series to be used when the back gear is employed, as when using large drills or when boring. The spindle, although belt-driven, for all sizes of drills under say 1½ inches, is provided with back gearing for larger sizes; in this respect it corresponds and acts as any back-geared lathe head used for the same purpose. The back gearing of this machine is in a convenient position on the saddle and within easy reach of the workman. The spindle is counterbalanced up.

The great advantage claimed is in the raising and lowering of the swinging arm as compared to those machines in which this arm is fixed at one length, and to which the work must be set. In this machine the work to be drilled can be clamped to a table, provided or rested on the bed plate or adjusted on trestles; in any case the work, when placed within range of the machine, has the spindle quickly moved to it by power and the drilling done with the least loss of time possible.

We learn that the makers claim many new features in this machine, which they will protect by letters patent. They make two sizes, one with 4 feet 6 inches and the other with 6 feet radius, each with power in proportion.



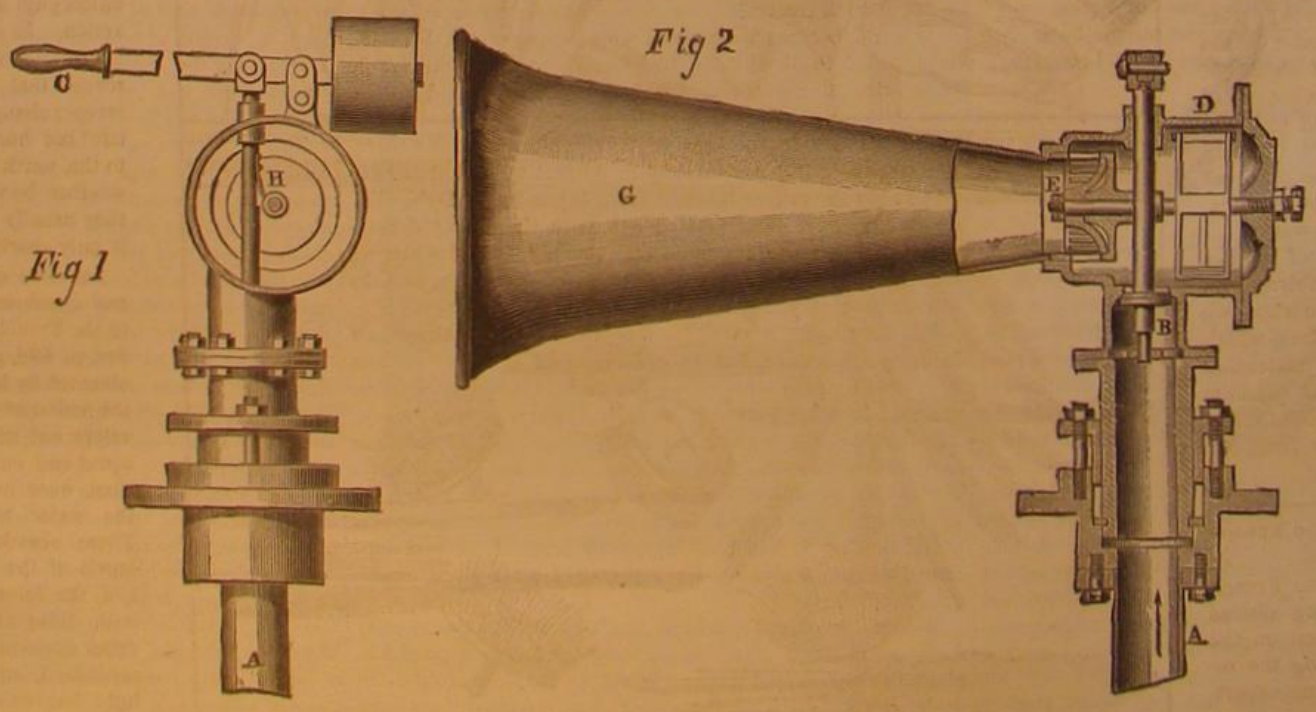
WM. SELLERS & CO.'S RADIAL DRILL.

IMPROVED STEAM FOG HORN.

The improvements in the fog horn, shown in the engraving herewith, were suggested by Professor Holmes, their object being to secure greater force and regularity to the action of the siren and greater penetrating power to the sound emitted.

It may be operated by compressed air or steam, which enters by the tube, A. The valve, B, is operated by the lever, C, admitting the steam or air into the chamber, D. At E are two slotted disks composing the siren, one rigidly attached to the shaft, the other loose. In its passage from the chamber to the large horn, G, the air or steam gives a rotary motion to the free disk, thus interrupting the current and producing the sound. This instrument is said to be very powerful.

It is made by Messrs. Sautter, Lemonier & Co., of Paris, and has been adopted for use on the French line of steamers from New York to Havre.



STEAM FOG HORN.

Domesticated Hornets.

A Western farmer has adopted an efficient but slightly risky method of ridding his house of flies. He has hung from the ceiling of his parlor a nest of hornets, transferred bodily from the woods. The removal of the nest did not seriously displease the hornets, and as they found the house well stocked with flies for food, they soon became familiar and harmless, devoting their energies to the extermination of the flies.

MISCELLANEOUS INVENTIONS.

Julia A. King, of Sherman, Texas, has patented a cough medicine consisting of a decoction of Indian pleurisy root (*Asclepias tuberosa*), saltpeter, honey, and brandy.

Mr. Walter Savage, of Crookston, Minn., has patented an improved snow plow for removing snow from railroad tracks. This plow is designed to be made of wood clad with iron to increase its weight, strength, and durability.

An improved cylinder for thrashing or hulling has been patented by Mr. James I. McClung, of Sidney, Ohio. The invention consists in constructing the cylinder with rabbeted and recessed lugs to receive the teeth, and in constructing the teeth with tenons or tongues, so that the teeth may be reversed and replaced.

A combined cradle and carriage has been patented by Mr. George F. Doyle, of Boston, Mass. The invention consists in combining with the rockers of a cradle the axles of a carriage, the axles being concaved to receive the rockers, so that the rockers and axles may be readily attached and detached.

A hat ironing machine, so constructed that the shell can be readily guided to all parts of the sides and crown of a hat body, has been patented by Messrs. R. S. Hedden and L. A. McCormick, of Newark, N. J.

An improved wagon brake has been patented by Messrs. W. L. Whitman, of Ringgold, Ga., and J. D. Igon, of James County, Tenn. This invention is an improvement upon the automatic wagon brake for which letters patent No. 196,406, dated October 23, 1877, were issued to W. L. Whitman and E. Manes.

A buckle, especially adapted for fastening and securing rolled cloths and other goods that are put up in rolls, has been patented by Mr. Calvin W. Polen, of Hazel Dell., Ill. The buckle is made of wire, bent so as to form a rectangular frame, having two square loops and a central crossbar that has two downward curved hooks, and it has a double-pointed and barred wire tongue placed on the central crossbar of the buckle, the tongue points being pointed in the direction opposite to that of the frame hooks.

Mr. Louis W. Ott, of Indianapolis, Ind., has patented an improved bedstead lounge which is readily opened and closed and is not liable to get out of repair.

An improved neck yoke has been patented by Mr. John W. Barton, of Emporia, Kan. The object of this invention is to provide an elastic support within the neck yoke for securing and holding the tongues of all kinds of vehicles, including reapers, mowers, and other machines.

Mr. Henry Thompson, of Brooklyn, N. Y., has patented a ventilated can in which milk or other liquid may be filtered and from which it may be drawn free from impurities.

A bath box for the use of photographers and others, by which the escape of poisonous gases, to the injury of the operator, is prevented, has been patented by Mr. James C. Macurdy, of Boonville, Mo.

An improvement in patterns for close-fitting sleeves for dresses has been patented by Mary A. Taylor, of New York city. In order to obtain the required fullness for the elbow, sleeves have heretofore been made in two pieces with a seam on the outer curve; but difficulty is experienced in joining the seam neatly on account of the fullness that has to be gathered in the seam. The object of this invention is to obtain a proper fit with the requried fullness for the elbow by a pattern that can be readily sewed up at the seams. The invention consists in a sleeve pattern made in a single piece and formed with a dart extending from one side toward the center to form a short seam that extends from the lengthwise seam of the sleeve to near the point of the elbow.

Mr. George P. Cole, of Johnstown, N. Y., has patented a composition for cleansing marble, etc., consisting of lime, whiting, sal soda, soft soap, fine salt, emery dust, fish oil, and water.

Mr. Thomas Wherritt, of Cynthiana, Ky., has patented an improved fire escape which consists in a swinging frame carrying a windlass having reel heads, a rope wound between the reel heads and of a length sufficient to reach to the ground, a set of friction straps fastened to the swinging frame and wrapped once or twice around the windlass on each side of the reel, and connected at their lower ends to a sleeve encompassing the rope, which sleeve is provided with an adjustable friction device, which, binding with the rope as it pays out, regulates the tension or brake action of the friction straps.

Messrs. F. Parker and F. Dumont, Jr., of Jersey City Heights, N. J., have patented a case for key and stem winding watches, the object being to produce light and inexpensive cases.

An improvement in the class of fire escapes adapted to be suspended from a window of a building, has been patented by Messrs. Robert Quintaville and Theodore Lindberg, of Brooklyn, N Y. It is more particularly an improvement upon such apparatus as consists of a frame that is designed to be attached to a window sill, and is provided with a curved standard, from which a basket or other receptacle for persons and goods is suspended by means of a rope running through a sheave or pulley block.

An improved wrapper for glass bottles for the purpose of obviating the danger of breakage, and also for protecting the labels from abrasion or other injury by contact of the bottles with each other or with other objects while being handled or shipped, has been patented by Mr. Martin V. Kacer, of St. Louis, Mo.

An improved hopple of the kind used for fettering animals to prevent their straying away, and to restrain their

movements so that they may be easily caught in the field, has been patented by Mr. Charles J. Gustaveson, of Salt Lake City, Utah Territory. The improvement consists in fetlock bands connected to the ends of a chain by simple and durable connection.

CURIOUS FACT IN NATURAL HISTORY.

BY C. F. HOLDER.

Our illustration represents the American iguana crossing a river, the Chagres, as wide as the Harlem at High Bridge, upon the surface of the water, without sinking below it. This wonderful performance was witnessed by Mr. John G. Bell, the well known naturalist and former companion of Audubon. Mr. Bell states that as he was approaching the river he came suddenly upon the reptile, and alarmed it so that it sprang into the river, but instead of sinking, to his surprise, it rushed along over the water, making its claws go like lightning, so that he could not see them, and thus keeping the whole body above the water. It made quite a foam behind, and in about two minutes was over the river, up the bank, and out of sight. When it is remembered that this animal weighs from five to ten pounds, and has slender claws fitted for tree-climbing, the wonderful character of the performance will be appreciated. It is from four to five feet long, and its general color is green shaded with brown. It has a strong and distinct crest running along the whole length of the back and tail, and a large dewlap or pouch under the throat, the edge of which is attached to a cartilaginous appendage of the bone of the throat. The tail is very long, slender, compressed, and covered with small, imbricated, keeled scales. It has a very formidable look at first sight, and when irritated it puts on a very menacing appearance, swelling out its throat pouch, erecting the crest on its back, and lashing its tail about with great violence. It is, nevertheless, a harmless creature, unless laid hold of, when it bites with considerable force. Altogether the occurrence is a most remarkable one and entirely antagonistic to the supposed habits of the animal.

IGUANA CROSSING CHAGRES RIVER ON THE SURFACE.

FRESH-WATER MEDUSÆ.

Our engraving represents the *Limnocodium sowerbii*, the fresh-water medusa, recently discovered in the Victoria Regia tank at Regent's Park, by Mr. Sowerby, the Secretary of the Botanical Society. Our scientific readers will observe in the structure of this unique jellyfish the exceptional characteristics which distinguish it from other medusæ, as pointed out by Dr. E. Ray Lankester in his report to the Royal Society, at a recent meeting of the Society; where also Mr. Sowerby showed a number of living specimens which he had kept in confinement, and mentioned some of their peculiar habits. If the water is not kept up to a temperature of about 85° Fah., the animal falls to the bottom of the water and remains torpid until the temperature is raised, when it again becomes active. He has also observed the medusæ feeding on the daphnia, which abounds in the same water.

The diameter of the disk of the medusa does not exceed one-third of an inch. Dr. Ray Lankester, to whom we are indebted for the sketch from which our illustration is engraved, states that it is the only medusa which inhabits fresh water, and must have been introduced with tropical weeds from the West Indies.—*Graphic.*

FRESH-WATER MEDUSÆ AT THE BOTANICAL GARDENS LONDON.

Influence of Light on the Transpiration of Plants.

The *Comptes Rendus* of the French Academy gives the following *résumé* of a paper, by M. H. Comes, on the transpiration of plants, being the results reached after numerous experimental researches:

(1.) The emission of aqueous vapor which takes place in plants is submitted not only to the action of the physical agents which influence the ordinary evaporation from a free surface of water, but also to that of light. Consequently, under equal conditions, a plant transpires more under the action of light than it does in darkness.

(2.) The action exerted by light on the transpiration of plants augments in proportion to its intensity. Consequently, under equal conditions, transpiration reaches its maximum shortly after midday.

(3.) Light favors transpiration only in the portion which absorbs it through the coloring matter of the organ. Consequently, under equal conditions, the organ which has the deepest color transpires most, and transpiration is most active in that part of the spectrum in which the light is most absorbed.

(4.) The luminous rays which are absorbed by the coloring matter of an organ alone favor the transpiration of such organ. Then, conditions being equal, the transpiration of a colored organ will reach its minimum under the influence of a light of the same color as the organ, and its maximum under the influence of a light of complementary color.

NATURAL HISTORY NOTES.

Digestion in Plants.—Dr. Lawson Tait has recently been investigating anew the structure and digestive principles of plants. While he has obtained complete proof of the existence of a digestive process in *Cephalotus, Nepenthes, Dionæa*, and the *Droseraceæ*, he entirely failed with *Sarracenia* and *Darlingtonia*. The fluid separated from one of the sundews (*Drosera binata*) he found to contain two substances, to which he gives the names "droserin" and "azerin." Dr. Tait confirms Dr. Hooker's statement that the fluid removed from the living pitcher of *Nepenthes* into a glass vessel does not digest. A series of experiments led him to the conclusion that the acid must resemble lactic acid, at least in its properties. The glands in the pitchers of *Nepenthes* he states to be quite analogous to the peptic follicles of the human stomach; and when the process of digestion is conducted with albumen, the products are exactly the same as when pepsine is engaged. The results give the same reactions with reagents, especially the characteristic violet with oxide of copper and potash, and there can be no doubt that they are peptones.

How Flying-fish Fly.—*Apropos* of an article on this subject in the *American Naturalist*, Prof. D. S. Jordan, the well known ichthyologist, gives the following statement in regard to the behavior of the large flying-fish *Exocœtus californicus:* This fish flies for a distance sometimes of nearly a quarter of a mile, usually not rising more than three or four feet. Its motions in the water are extremely rapid, and its motive power is certainly the movement of its powerful tail in the water. On rising from the water the movements of the tail are continued for some seconds until the whole body is out of the water. While the tail is in motion the pectorals are in a state of very rapid vibration, and the ventrals are folded. When the action of the tail ceases, the pectorals and ventrals are spread, and, as far as can be seen, held at rest. When the fish begins to fall, the tail touches the water and the motion of the pectorals recommences, and it is enabled to resume its flight, which it finally finishes by falling in the water with a splash. When on the wing it resembles a large dragon-fly. The motion is very swift; at first it is in a straight line, but this becomes deflected to a curve, the pectoral on the inner side of the arc being bent downward. It is able to some extent to turn its course to shy off from a vessel. The motion seems to have no reference to the direction of the wind.

The Use of Chlorophyl in Vegetable Growth.—This question appears to be as yet by no means definitely settled. Pringsheim, it will be remembered, recently suggested that chlorophyl was chiefly of use as a screen to protect the subjacent cells and their contents from those rays of light which would be adverse to the secondary processes that have been distinguished as growth. But Dr. Gilbert, in his recent address to the Chemical Section of the British Association, points out that the plant may receive abundance of nitrogen, may produce abundance of chlorophyl, and be subject to the influence of sufficient light, and may yet not assimilate a due amount of carbon. He shows that the presence of a due supply of potassium salt and of sufficient available nitrogen is necessary for the proper assimilation of carbon by plants. The amount of carbon assimilated evidently does not depend on the protective power of the chlorophyl alone, nor on its chemical action. In connection with the coloring matter of leaves it has been observed that the leaves of the Virginia creeper change to the well known beautiful red hue sooner on walls exposed to the north and east, and that if the weather be wet during the time when they usually change color the red tint is only sparingly developed.

Influence of Colored Lights on Animal Development.—M. Yung, in a note to the French Academy (*Comptes Rendus*, p. 440), gives some of the results obtained by him in his experiments on the action of colored lights on the development of animals. Eggs of the squid and cuttlefish, laid at the same time, were put into vessels in which the water was regularly renewed. These vessels were placed in glass bowls of the same form, but larger, and the intervening space was filled with different colored liquids. The upper surfaces were covered with thick cardboard, so that the eggs received light that was nearly monochromatic. Under such conditions the eggs developed unequally, as had previously been found the case with the eggs of the frog, trout, etc. The development was stimulated by violet and blue lights, but retarded by red and green. Yellow light, in its action, came nearest to white. In experimenting with the beautiful ascidian *Clona intestinalis*, M. Yung found that those larvæ which were reared in vessels submitted

to violet light grew more rapidly and developed into much more vigorous individuals than those reared under other colored lights. These results, taken in connection with the like ones obtained by M. Serrano-Fatigati on infusoria, seems to show one general character for aquatic animals. It now remains to be seen whether terrestrial animals are influenced in the same way.

TRANSACTIONS OF THE AMERICAN SOCIETY OF ENGINEERS.

The above named publication for the month of November contains some important papers.

The subject of

"WEB STRAINS IN SIMPLE TRUSSES WITH PARALLEL OR INCLINED BOOMS,"

is ably discussed in a paper read by Mr. Elnathan Sweet, Jr., at the twelfth annual convention of the society, held May 25, 1880. Mr. Sweet, in this paper, aims at greater directness and simplicity in the treatment of the subject than has hitherto been attained; and he asserts that the handbooks hitherto published base their solutions of the problems relating to this class of trusses upon a false assumption. This assumption is, that as a moving load passes over the panels of a truss, each panel is fully loaded before the adjacent triangle in advance bears any part of the load.

"In trusses with a single system of triangulation, or those in which the web strains of any panel pass to the abutment through the web members of the adjacent panel, this assumption is obviously erroneous, for the instant the head of the load passes a panel joint of such a truss a part of it is transmitted by the floor system to the adjacent triangle of the same system."

With this proposition in view, the author proceeds to a somewhat abstruse mathematical discussion, in which he adopts as the most natural unit of length the panel length. By this means he is able to simplify the formulæ necessary so considerably as to justify the wisdom of the adoption of the panel length as the unit of length, and to determine the maximum shearing strain at any panel joint by much less complex expressions than have been heretofore required.

A DISCUSSION UPON INTER-OCEANIC CANAL PROJECTS,

referring to former papers which have appeared in the *Transactions*, together with additional information obtained by recent surveys in Nicaragua, by Mr. A. G. Menocal, throws much light upon current questions relative to the problem of communication by means of canals between the Atlantic and Pacific oceans. As an abstract of this paper cannot be given without reference to the papers criticised in it, we can only glance at one or two salient points. One of these is ably taken. In speaking of a canal on the Nicaragua route, the time of transit ought to be estimated not as though the whole distance were canal transit, but the transit ought to be separated into its component parts, to wit: "Canalization, 62 miles; slack water navigation, admitting nearly ocean speed, 63 miles; and lake navigation, admitting ocean speed, 56½ miles;" total, 181½ miles. The time of transit would, therefore, be shortened very much below that estimated by some engineers; indeed, it could be accomplished in 38½ hours, the transit including a lockage of 108 feet.

The practicability of utilizing the channel of the river Grande is another point strenuously urged by the writer in favor of the Nicaragua route.

Minutes of meetings and the annual reports of the Board of Direction, Committee on Finance, the report of a Committee on a Uniform System of Tests for Cements, and a list of members, with additions, changes, corrections, and resignations, complete the contents.

The Committee on Tests for Cements make only a brief report, enumerating an extensive series of papers received from different parts of the world bearing upon the subject, stating that they will commence an interchange of views during the present winter, and announcing that they will endeavor to complete their duties on or before the date of the next annual convention.

Meteorological Observations by Telegraph.

Mr. N. Hoffmeyer, of Copenhagen, observes that "in meteorological prognoses we cannot expect a scientific certainty; these prognoses are based upon empirical suppositions, and are, therefore, subjected to all possible errors which may be caused by that method. So long as the causes and the real nature of meteorological disturbances have not yet been explained, so long as we are only able to know the *how* and not the why of meteorological phenomena, so long a very exact observation only of the storms which by telegraph is transmitted from one coast to another, will be of practical value to the mariner."

This observation, however, is connected with greater difficulties than has been hitherto supposed. Mr. Hoffmeyer has, during a period of 21 months, made the closest investigations in regard to the storms and winds on the Atlantic Ocean, and he maintains that the conditions upon which these meteorological phenomena depend are so highly complicated that the telegraphic reports sent by the "*Herald* Weather Department" from America to Europe—although being a proof of the energy and ability of Mr. Bennett—have an imaginary value only.

It has been proved that the atmospheric disturbances usually move in the same direction across the ocean as across the continents, viz., from west to east, and that about 61 per cent of the storms which we have to encounter on the Atlantic have arrived there from the American continent; but it is also known that 39 per cent of the storms—a number not to be overlooked—are originated upon the Atlantic itself, and that besides only 50 per cent of the storms observed on the Atlantic arrive at Europe. The direction which the atmospheric disturbances show in America, before they arrive at the coast of the Atlantic, can be no secure basis for conclusions regarding the further course of these disturbances and the phenomena connected with them. Even if the observations on the European and American coasts were to be combined, a reliable prediction of what will happen on the ocean will be impossible. If, therefore, meteorological observations shall have a real benefit for our mariners, such observations must not only be made on the coast, but also on the Atlantic itself, and Mr. Hoffmeyer proposes to erect for this purpose a regular meteorological service, the stations of which are situated upon the ocean—*i. e.*, upon islands which lie between the two continents. These stations should be connected by telegraph with the continents, so that Faroe Island, Iceland, South Greenland, and the Azores may be brought into communication with the European coast and the Bermudas with North America.

Although these stations are very distant from each other, the meteorological observations made there will, on account of a meteorological peculiarity of the Atlantic, be of value for predicting the weather and atmospheric disturbances which will occur between these stations.

Mr. Hoffmeyer, by daily constructing synoptical maps, discovered that the barometric minima in the atmosphere which rests upon the Atlantic have a tendency to approach Greenland and Iceland on the one hand, and the Azores on the other, while from the latter to the Bermudas may be usually observed a high pressure of the air and fine weather. Even a slight change taking place at this part of the ocean predicts almost to a certainty great disturbances in the other regions. This barometric maximum, according to Hoffmeyer, forces the depressions of the atmosphere to take a certain direction and influences their velocity of movement in a high degree. Therefore it is absolutely necessary to be acquainted with these atmospheric maxima which prevail upon the ocean, and they can naturally be observed only upon the ocean itself—*i. e.*, upon those islands mentioned; therefore observations made there, in connection with those made on the coast, will be perfectly sufficient for all practical purposes. Mr. Hoffmeyer hopes, proceeding upon this basis, to perfectly transform our meteorological service, and to enable our scientists not only to predict the weather for a day or two, but for a longer period of time. The importance of such predictions for the transatlantic navigation is evident. The synoptic maps will enable the ships leaving the ports to enter regions which are subjected to great atmospheric changes, and to choose those ways which, during a certain time of the year, are the least exposed to danger; they will give important information about the condition of the monsoons near the Azores, which are much more irregular than they are generally supposed to be; and they will be valuable for the owners of vessels in making it possible for them to account for possible delays of their ships.

Mr. Hoffmeyer's labors have been communicated to the meteorological institutions of Europe, and necessary steps will probably be taken to make a practical use of the suggestions of this gentleman, as the resolutions, taken April 3, 1880, at an assembly of the presidents of the German meteorological stations at Hamburg, highly recommend the suggestions made by Mr. Hoffmeyer.

Paper Pulp from Wood.

The following interesting description of the process of making wood pulp is from an account of the opening of the Thorold Pulp Paper Company's establishment published by the Thorold *Post*, Canada:

"The wood, four feet in length and of any thickness, is brought in at the basement, placed in the barking-jack (one stick at a time), where two men, with draw knives, rapidly peel off the bark. It is then conveyed by the elevator to the first floor, sawed in two foot lengths with cross-cut saws, passed on to the rip raw, where it is slabbed (that is, a small portion of wood on opposite sides taken off), to permit it resting firmly in the grinding engine. It is then passed to the boring machine (an upright one and a half inch auger, with foot attachment, driven by power), where the knots are bored out. The wood is then placed in racks of the same size as the receptacle in grinding engine and carried out to be ground. The grinding engines are upright, and receive at a filling one-twentieth of a cord of wood. The wood is placed in a receptacle, and by a simple, variable, automatic feed process is pressed flatwise between two outward revolving rolls, composed of solid emery, which are flooded with a spray of water, carrying off the fibrilized pulp in a stream through revolving screens to the tank or stuff-chest in the basement. It is then pumped up into a vat that forms part of the wet machine. In this vat is constantly revolving a large cylinder faced with fine brass wire cloth, which picks up the particles of pulp out of the water and places them on the felt (an endless piece of woolen goods which makes between rolls, for different purposes, a continual circuit of the wet machine). On the cylinder is turning a heavy roll, called the concha; between the two, where they meet, the cylinder leaves the pulp, with most of the water pressed from it. The pulp now makes its appearance on the felt above the concha roll in a beautiful sheet, thirty-eight inches in width, and is carried along in a steady flow a distance of about eight feet, where it passes between (the water here again being pressed from it) but not beyond two heavy rollers, the upper iron, the lower wood; it adheres to the upper roll, which is constantly turning, wrapping it up, and when a sufficient thickness is attained, is cut off by a knife being pressed to the roll, attached to the machine for that purpose. It now leaves the roll in a thick, white sheet, 36 x 38 inches, which is received by the boy in attendance on a table conveniently attached to the machine, and folded into sheets 14 x 26 inches. It is then placed on scales until the weight is one hundred pounds, when it is placed in the press and firmly tied into square compact bundles. It is now ready for shipment to the paper mill to be made into printing and tea paper. The wood paper pulp has been placed in the market and found a ready sale. Last week a contract to the amount of $1,000 was made with one of our large paper mills."

Loss of Water Pressure in Hose Pipes.

The recent engine test in New York city was interesting in many ways, but in none more so than as exhibiting the loss of power by friction in hose. Two hundred feet of Maltese cross rubber hose were laid from the engines, and at the base of the playpipe a gauge was inserted in the line. The steamers were working at from 100 to 120 pounds steam pressure. The following table exhibits the average general pressures taken every three minutes simultaneously:

Engines.	Steam Pressure.	Water Pressure at Engine.	Water Pressure at Pipe.	Loss by Friction in Hose.
Clapp and Jones	110·83	173·55	93·03	80·50
Ahrens	120·33	166·70	88·38	78·32
Amoskeag	101·64	143·14	74·54	68·60

From this it will be seen that the loss of power by friction in 200 feet of hose was very nearly 50 per cent. Had there been 1,000 feet of hose, the loss would have been very much greater, of course. The size of the hose used was 2½ inches. Had it been 4-inch hose, as the *Journal* has advocated for fire service, the friction loss would have been far less. In his little book entitled "Fire Streams," Chief Leshure, of Springfield, Mass., gives numerous valuable tables illustrating the friction loss in hose. He says: "It may be stated as near enough for most practical purposes, that when delivering the same number of gallons per minute, the friction loss in two pipes (or hose) of equal lengths, the diameter of one of which is twice that of the other, the loss in the larger will be one thirtieth of that in the smaller, or the loss in the smaller will be thirty times that in the larger." A better argument for increasing the size of hose for fire service could not be put forth. The weight of the hose need not be materially increased, for the present hose is made unnecessarily heavy to withstand fictitious pressures: that is to say, hose is now made and warranted to withstand anywhere from three to six hundred pounds pressure. When in actual service the pressures seldom exceed those given above. In a 4-inch hose it would be almost impossible to get 200 pounds pressure on the hose at any point in the line, and the hose could be made correspondingly lighter. As a matter of fact, 4-inch cotton hose is now made in large quantities for mining purposes that weighs but 70 pounds to the section, while much 2½ inch fire hose weighs fully as much or more —*Fireman's Journal.*

ENGINEERING INVENTIONS.

An improved rotary engine has been patented by Mr. John H. Newell, of Scottville, Ill. The invention consists in mechanism for operating the valve, and the combination therewith of a variable cut-off.

An improved stock car has been patented by Messrs. James V. Brown and Benjamin R. Neal, of De Soto, Ill. The object of this invention is to construct a car for transporting cattle and other live stock, so that the car can readily be divided into two or more stalls, and the food and water be conveniently transported and fed to the animals.

Mr. Daniel Kunkel, Sr., of Oregon, Mo., has patented an improved car coupling, so constructed that the cars will be coupled automatically as they are run together, also permitting their convenient uncoupling.

Chemistry of Plants.

Dr. S. Ringer, who has for some time past been experimenting upon the physiological action of *Narcissus, Galanthus, Hæmanthus*—genera belonging to the natural order *Amaryllidaceæ*—has recently examined the properties of an alkaloid from the common garden tulip—a liliaceous plant, and communicated his results to the *Practitioner*. It has been found by him that nitrate of tulipine differs almost entirely from the alkaloids derived from the amaryllids, it being a muscle poison which affects the muscles like veratria, but to a less degree. These results are interesting from a botanical as well as a physiological standpoint, as going to confirm the theory that the relationships between natural orders may, to a certain extent, be indicated by the nature of their chemical constituents. The nearer relationship of the *Liliaceæ* to the *Melanthaceæ* seems shadowed forth by the fact that a liliaceous plant has yielded an alkaloid like veratria. In the same manner the position of the Australian genus *Duboisia*, as belonging to the *Solanaceæ* rather than to the *Scrophulariaceæ*, was demonstrated by the elimination of the alkaloid duboisine, and the discovery that its physiological action was analogous to that of the solanaceous alkaloids.

Impromptu Ingenuity.

Some years ago, a Spanish steamer, while crossing the Bay of Biscay in a severe storm, gave such indications, by an unusual noise at the stern, that there was something wrong with the screw propeller or its shaft outside of the ship—that is, in the open space between the stern and rudder posts where the screw revolves. There was no dry dock in any of the ports on the coast where the ship could go to be examined; and on arrival at Vigo it appeared as if there was no alternative but to remove the cargo from the stern, and by placing it forward thus lift the screw propeller and shaft to the surface of the water. The alternative, simple as it was, meant a serious delay and great expense. Before commencing to remove the cargo, another consultation was held. It was then decided to put the stern of the ship over a bed of light colored sand; and as the water was very clear, there might be a possibility of ascertaining the extent or cause of the mishap. For two days after the vessel was so placed, the wind caused a ripple on the water, which effectually prevented anything being seen. It was then suggested by some one on board to try the use of oil on the surface of the water round the stern of the ship. The effect was most satisfactory. The water was becalmed as if by magic, and it was then seen that the wedge or key which keeps the propeller in its place on the shaft had come partly out, and thus left the screw loose on the shaft, which caused the noise. By continuing the use of oil for a few hours the wedge was ultimately driven into its place and secured. Many days of detention and the use of costly appliances and labor were thus saved.

A few years ago an iron bridge of considerable length, the weight being about two hundred tons, was constructed in England, and erected in a remote part of Germany. By some mishap, the bridge, when finished, was found to be some distance "out" to one side, an error which the proprietors insisted should be rectified. To take down and recrect the bridge would be simply ruin to the contractor. But necessity is the mother of invention, and so it proved in this case. It was summer time, and the contractor proceeded to find the amount of expansion which was caused by the heat of the sun over the whole length of the bridge. He next ascertained what contraction took place in the night by cooling. Armed with these data he thought it might be possible to bring the bridge to its proper position in a few days. The bridge, of course, in its ordinary condition, expanded from the center, pushing its two ends outward, or farther apart, and again contracting toward the center. Taking advantage of these conditions, one end was made fast in the morning, and the bridge was forced to expand from that immovable point, instead of from the middle, as formerly. When the iron composing the bridge had expanded to its full extent in the direction intended, that end was released, and the opposite end made fast. The bridge then contracted toward its true position. Thus, whatever was gained by the day's expansion was secured by the subsequent contraction when the metal cooled at night, and the process being renewed day by day, the work was successfully accomplished.

An ingenious application of expansion and contraction in metals was made use of in France, and has frequently been taken advantage of since. The walls of a large building in Paris were observed to be giving way by bulging outwards, and the problem was to bring them back to their vertical position. For this purpose a number of bars of iron having screws and nuts on each end were let through the opposite walls and across the intervening space between them. The nuts and screwed portion of the bars were outside. The bars were now heated by a number of lamps suspended below them until they had expanded as much as possible, and the nuts screwed up against the outsides of the two opposite walls. The lamps were next removed, when the heated bars, in cooling, gradually contracted in their length, bringing the walls very gently, but with irresistible force, into their normal position.

It is well known that in working iron, such as welding two pieces together, and even in its manufacture, hollow places or flaws occur, with merely an outside skin over the defective parts, which any test but a destructive one would fail to discover. Nor would it be difficult to point out numerous examples of disaster thus occurring. To test the homogeneity of the metal, a bar of iron is placed on the equatorial line. A compass with a very sensitive needle is passed along in front of the bar, the needle of course pointing at a right angle to it. If the bar is perfectly solid through its whole length, the needle will remain steady. If, however, there should be a flaw or hollow place in the bar, the needle will be deflected as it passes from the solid to the hollow place, *backward* toward the solid iron; passing on over the hollow place, the needle will come within the range of the solid iron at the other end of the flaw, and will again be deflected *forward*. If the bar be cut through anywhere between these two points of deflection, a flaw will invariably be found. Many thousands of pieces of iron—some prepared for the purpose of testing this method of trial, others in the ordinary course of business—have been operated upon with the same unvarying result.

A striking instance of ingenuity in taking advantage of the resources of nature in an emergency, is found in Sir Samuel Baker's account of his travels in Abyssinia. His stock of soap had become exhausted; and as he possessed abundance of various kinds of fat, including that of elephants, hippopotami, lions, and rhinoceros, he determined to convert a quantity of this grease into soap. For this purpose he required both potash and lime; and how were these to be obtained? The negleek tree, he found, was exceptionally rich in potash; he therefore burned a large quantity, and made a strong lye with the ashes, which he concentrated by boiling. There was no limestone; but the river produced a plentiful supply of oyster shells, which, if burned, produce excellent lime. What was next wanted was a kiln in which to burn the shells, and this he constructed out of one of those great ant hills, which rise to ten feet high, common to those valleys, and which possess a very hard external crust. Two natives hollowed out one of those hills; a proper draught hole was made below from the outside; it was loaded with wood, and filled with some six bushels of oyster shells, which were again covered with fuel; and after burning twenty-four hours a supply of excellent lime was obtained. Then commenced his soap boiling, which was effected in a large copper pot of Egyptian manufacture. The ingredients of potash, lime, and fat were then carefully mixed; and after boiling ten hours, and having been constantly stirred, he obtained excellent soap, of which he had in all about forty pounds weight.

National Value of Cheap Patents.

At the December 6th meeting of the Society of Engineers, London, Mr. Joseph Bernays, President, in the chair, a paper was read by Mr. Frank W. Grierson on "The National Value of Cheap Patents." The author pointed out that inventors, like all other men, did not work for the mere sake of working, but for their own advantage. In obtaining an advantage for themselves, however, they conferred upon the whole nation a much greater advantage. The advantage an inventor sought was secured to him by a patent; patents should, therefore, be granted at as low a cost as possible. A patentee was desirous of providing improved processes and means of doing what had not before been possible; or of doing something in a quicker and more economical manner than had before been possible. Inventions were very seldom "happy thoughts;" they were nearly always the result of much consideration and many experiments, neither of which would be undertaken for the mere love of the work, but which were undertaken in the hope of reward in the form of a successful patent. The patentee had an obvious incentive for getting his invention known and adopted; if it was not an improvement it would certainly not be adopted, but if it was, it would be adopted only in consequence of his persistent efforts, and by its adoption a step in advance had been made.

After referring to the evil of "orphan" inventions, the author gave the details of the stamp duties on British and American patents, from which it appears that the stamp duties on a patent in that country, lasting only 14 years, are 175*l.*, while those on an American patent, lasting 17 years, are only 7*l.* A table was then given of the patents applied for and granted in the United States and in Great Britain during the last ten years, from which it was shown that the 50*l.* stamp duty at the end of the third year kills about 70 per cent of the patents granted, and that the 100*l.* duty destroys very nearly 20 per cent more, leaving only 10 or 11 per cent to complete the full term. The effect of these crushing duties is that while on December 31, 1879, there were in Great Britain only 15,755 patents in force, in the United States there were more than 200,000, not including designs. The United States thus have thirteen times as many patents in force at the same time, and therefore make thirteen efforts to advance for each one that the English make. During the last ten years 22,868 British patents have been crushed by the heavy stamp duties. An American patent, once granted, lasts the full term without further payment. The result of this is seen in an enormous import of American goods of varied description, and in the continued flow of skilled artisans to America. Mr. Grierson then gave the following comparative table of average results for the last ten years:

	British Isles.	United States.
Receipts	158,980*l.*	143,089*l.*
Expenditure	48,064*l.*	125,294*l.*
Profit	110,917*l.*	17,795*l.*
Stamp duties on one patent	175*l.*	7*l.*
Maximum duration of patent	14 years.	17 years.
Average " " "	5 "	17 "
Number of patents applied for	4,496	19,770
" " " granted	2,980	13,335
" " applications refused or abandoned	1,516	6,415
" " grants paid 50*l.* duty	830	
" " " " 100*l.* duty	353	
" " " killed by 50*l.* duty	1,851	
" " " " " 100*l.* duty	430	
Percentage of applications granted	66·28	67·55
" " " refused or abandoned	33·72	32·45
" " grants paid 50*l.* duty	30·70	
" " " " 100*l.* duty	11·18	
" " " killed by 50*l.* duty	69·30	
" " " " " 100*l.* duty	19·52	
" " " lasting full term	11·18	100·00
Population	34,000,000	50,000,000
Number of persons to one patent granted	11,577	3,811
Ratio of amount of duties on one patent	25	1
" " number of patents granted	1	3
" " " " in force	1	8
Average cost to inventor for one patent, including patent agent's charges	180*l.*	19*l.*
Technical examination of applications	None.	Careful.
Inventions invalidly repatented	Frequently.	Rarely.

Mr. Grierson went on to observe that this table showed that in the United States three patents were granted for one there, after allowing for the difference in population, and that the stamp duties on one patent there would pay those on twenty-five patents in the United States. We might, therefore, fairly say that the British inventor was handicapped 25 to 1 in favor of the American inventor. It was to be carefully remembered that in handicapping the inventor they handicapped the nation. The author drew attention to Mr. John Standfield's proposal for reduced stamp duties, which was as follows: On application (to cover cost of provisional protection), 2*l.*; on filing complete specification (to cover cost of printing, etc.), 3*l.*; total, 5*l.*; there should also be an annual tax of 1*l.* Provisional protection to be granted for one year, and the duration of patents to be twenty-one years. After remarking on the advantage of official technical examination of applications, the author pointed out that it was impossible to calculate the enormous indirect loss the nation suffered from the present exorbitant patent stamp duties, which drove abroad and stifled a large proportion of that inventive faculty upon which alone they were dependent for holding their place among the nations, and which might, if not so hampered, save a considerable number of lives now annually lost in preventable accidents, and might give employment to many who are now unable to obtain work, and who in consequence have to be supported in idleness.

DECISIONS RELATING TO PATENTS.

United States Circuit Court.—Southern District of New York.

MATTHEWS *vs.* SCHONEBERGER *et al.*—PATENT BOTTLE STOPPER.

Blatchford, J.:

1. Every claim of a patent has reference to the descriptive part of the specification, and must be construed as if the words "substantially as specified" formed part of said claim.

2. So where the specification speaks of a part or feature of the patented device as being "an important feature of the invention," and makes it a part of the claim, the omission of such feature from defendant's device saves him from infringing the patent.

3. Where a prior device accomplished the same thing, but not so perfectly as the patented device, the claim to the latter must be limited to its precise construction whereby it accomplishes the results more perfectly, and will not include other means of doing it.

4. A function cannot be claimed. The claim must be either to the physical structure, the combination of devices, or the method of operation.

5. The Codd bottle stopper, consisting of a glass marble inside of a bottle seating against a rubber seat in the mouth of the bottle by the pressure of gases from within, is not an infringement of the Albertson patents for a gravitating stopper consisting of a stem with a rubber valve or skirt around it, which seats on the interior of the neck of the bottle.

This suit was brought on two patents. One of them is a reissue, No. 2,386, granted to the plaintiff October 30, 1866, for an improvement in bottle stoppers, the original patent having been granted to Albert Albertson, as inventor, August 26, 1862. This patent has expired.

The second patent sued on is No. 44,684, granted October 11, 1864, to J. N. McIntire, on the invention of Albert Albertson, for an improved method of stopping bottles.

Bill dismissed.

Concrete Blocks.

In reference to the art of concrete block building, Mr. Imrie Bell, of London, has been much struck by the want of attention paid to the art of producing a fair and finished surface in the exposed faces of the blocks, as exemplified in many of the large engineering works in course of construction in the metropolis and elsewhere, where the exposed faces of the concrete present a rough honeycombed appearance, with the marks of the joints of the timber planks forming the moulds in which the blocks have been formed, or the frames inside of which they have been built *in situ*, in place of showing a fair and smooth surface. The author has given this matter much consideration, and the result of his experience is that in concrete building it is perfectly easy, with a little attention, not only to produce a fair surface, but to form mouldings and panels, and even tracery and ornament, and at the same time make this face work as durable and solid as any part of the block. There are two reasons why little attention has hitherto been paid to this art—one is carelessness or indifference to appearance, the other is that most engineers who have attempted it have done so by "rendering," a most objectionable and dangerous mode of effecting the object; and which, even if successful for a time, is simply veneering, and is subject at any time to decay, the failure generally occurring after wet and frosty weather, which has naturally caused a want of confidence, and stopped a repetition.

The plan which the author has followed, and with complete success and at an inappreciable increase of cost, by which a smooth, uniform, and equal colored face can be obtained (and if wanted, the color of the blocks might be slightly varied by different colored sand), and which, both above and below low water, has stood successfully the test of eight years' exposure to frost, heat, storm, and rain. This plan is simply to have a smooth-planed board for the face of the mould painted previous to commencing the work with a mucilage of soap, and to line inside with a finer concrete or mortar as the work proceeds, so that the mixture placed close to the face boards is carried up with that contained in the body of the block, the whole forming one homogeneous mass, and insuring that the setting process of the whole mass shall progress simultaneously; and in fact this face, like the skin of cast iron, is actually the strongest portion of the block.

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.

(1) A. H. S. writes: Having heard the statement from old hunters that a rifle ball gains in velocity after leaving the rifle barrel, I wish to ask if it is true; and, if it is, what gives it an increase of velocity? I have stated that the greatest velocity is at the instant the ball leaves the barrel; but several say that a ball will penetrate further into a plank placed at a distance than it would if it were within a few feet. A. You are correct. The greatest velocity is just as the ball leaves the muzzle of barrel.

(2) G. M. J. asks: Is a jacketed steam cylinder containing steam from the boiler direct or live steam a saving or the reverse? A. We believe it is yet a "mooted" question among engineers whether a jacket heated by live steam is a source of economy. Some say it is, but we think the majority consider good felting or other non-conductor quite as economical.

(3) J. V. D. asks how to anneal steel to make it very soft. A. For a small quantity, heat the steel to a cherry red in a charcoal fire, then bury it in sawdust, in an iron box, covering the sawdust with ashes. Let it stay until cold. For a larger quantity, and when it is required to be very soft, pack the steel with cast iron (lathe or planer) chips in an iron box as follows: Having at least half or three-quarters of an inch in depth of chips in the bottom of the box, put in a layer of steel, then more chips to fill spaces between the steel and also the half or three-quarters of an inch space between the sides of the box and steel, then more steel; and lastly, at least one inch in depth of chips, well rammed down on top of the steel. Heat to and keep at a red heat for from two to four hours. Do not disturb the box until cold.

(4) J. Q. asks: If a pipe two inches in diameter is flowing into a cistern, how many pipes, one inch in diameter, are required to carry away the water that will flow through the two inch pipe? The pressure on the pipes is equal and the incline is equal. A. Four, leaving out of the question the friction of the water passing through the pipes.

(5) J. G. writes: 1. I want to make fifteen electro-magnets of about the same strength as common two-inch horse shoe magnets that are sold in the city at ten to fifteen cents each. What sized wire and how much will be required for each magnet (they are to be connected close together)? A. Make the cores of your magnets three eighths of an inch in diameter and one and a half inch long, and wind with six or eight layers of No. 20 magnet wire. 2. How many cells of gravity battery will I need to work them, the battery being also close to the magnet? A. You should allow one cell of battery for each magnet, if you work them all at the same time.

(6) C. R. A. writes: I am making a small yacht, 15 feet long and 42 inches beam and 3 feet depth of hold; engine 3x4, to run at 300 revolutions, and be 1½ horse power; boiler 20 inches diameter by 30 inches in height; supposed to run from eight to ten knots an hour. Do you think that is beam enough? A. Yes; but keep all your weights as low in the boat as you can.

(7) J. H. W. asks: 1. What is the horse power of an engine 20 inch diameter of cylinder, 48 inch stroke, making 55 revolutions per minute, with 70 pounds steam pressure to the square inch? A. See SUPPLEMENT, 253, for rule for calculating horse power of engines. 2. Where can I get some good books on steam engineering? A. Write industrial publishers who advertise in our columns. 3. What was the horse power of the engine that ran the machinery at the Centennial? A. 1,200 to 1,400 horse power, but only one-eighth to one-tenth of this power was used.

(8) J. D. C. writes: I have a gauge connected with a set of boilers, and eighty feet away I have another gauge. The carrying pipe is thoroughly covered, boxed, etc. The pressure on each glass is exactly the same, that is, at boilers 40 lb., eighty feet away 40 lb. Is the temperature of the steam the same at both gauges? A. If there is steam at both gauges, and the pressures are equal, the temperature will be the same; but it is probable that in use you have water and not steam in the gauge which is eighty feet from the boilers.

(9) C. W. asks: 1. How many Bunsen cells, ordinary size, will it take to make an electric light? A. To make an electric light of any considerable power will require 25 cells. 2. If a Knowles steam pump were to be made to run by compressed air at the rate of thirty strokes a minute, and a pressure of 100 lb., and to pump air into the same vessel that it is taken from to run the pump, could you keep the pressure the same, or would it increase or diminish? A. The pressure would diminish.

(10) J. J. asks: How are the bottoms of boots and shoes finished to give them a good bright polish and light color? A. The color is independent of the polish, the latter being made by vigorous work with the rub stick, after the sole has been buffed. All good oak and union leather will make a fair colored bottom, though some tannages are lighter than others, but in many of the hemlock tannages, where the hide is "plumped" by a mineral acid, the color is very dark. Some of the manufacturers stain such hemlock bottoms to imitate oak, but on account of the acid in the leather, the color given is not enduring. One stain much used is made of equal quantities of borax, oxalic acid, and water, with which the sole is dampened, and, when nearly dry, it is rubbed with French chalk or pipe-clay.

(11) E. B. K. asks: 1. When does a gas holder give the greatest pressures, when completely filled or when nearly empty? A. When completely filled. 2. Is it possible to entirely shut off the pressure on the street mains (gas) by the gover nor; that is, so that no pressure will show on the pressure gauge? A. Yes, if pipes, valves and connections are perfectly tight, and the initial pressure in the pipes is relieved.

(12) W. H. asks: What is the composition of the indelible ink used with type by shirt and collar makers? A. Nigrosine dissolved in a sufficient quantity of water. Printer's ink is also used.

(13) W. E. S. asks: 1. How strong will a battery need to be to heat to redness a strip of platinum half an inch long, one-eighth of an inch wide, and one-sixty-fourth of an inch thick? A. Use twenty quart Bunsen or bichromate cells. 2. Can a strip of platinum as above be heated to or nearly to redness while in close contact with glass? A. Yes. 3. I send a sample of shell marble; is it of any value? A. The shell marble is of little value.

(14) C. S. P. asks: Will the addition of say 25 per cent of almond or olive oil, to kerosene oil of 112 degrees reputed fire test, render it practically non-explosive? If not, then what may I add to attain this end? A. Nothing can be added to poor kerosene oil that will effectually prevent the escape of the volatile hydrocarbons which make it dangerous. These can easily be separated, however, by fractional distillation.

(15) A. H. R. says: In the study of chemistry great difficulty is experienced by many students in remembering the formulæ of chemical substances, and the want of a short and concise reference book has been our constant trouble. He suggests the following form. The metal sodium forms a series of salts:

Na_2O	Sodic Oxide,
Na_2S	" Sulphide,
Na_2SO_4	" Sulphate,
$NaCl$	" Chloride,
$NaNO_3$	" Nitrate,
$NaHO$	" Hydrate,

and the metals hydrogen, potassium, and ammonium, form the same series. The metal barium forms the compounds

BaO	Baric Oxide,
BaS	" Sulphide,
$BaSO_4$	" Sulphate,
$BaCl_2$	" Chloride,
$Ba(NO_3)_2$	" Nitrate,
$Ba(HO)_2$	" Hydrate,

and the metals strontium, calcium, zinc, lead, copper, silver, mercury, form the same compounds. A. There are several recent publications (German) on chemical formulæ in which tables similar to those you suggest are employed. In such books the new system of nomenclature (which is now in almost universal use) should be employed; and in order to make the book serviceable to others besides chemists proper, the various names (older) under which each substance is known to the pharmacist or druggist and in the trades should be added in a "ready reference" and comprehensive form.

(16) W. H. B. asks: Is there a process by which I could nickel-plate faucets myself? also, if I can do it without taking them off while plating them? A. You cannot nickel-plate the faucets without taking them off. See article on nickel plating, p. 209, Vol. 38, SCIENTIFIC AMERICAN.

(17) L. D. G. asks: 1. Is the pressure on the feed pipe the same as on the boiler? A. A trifle more. 2. Is the pressure on the glass water gauge or tube the same as on the boiler? A. Yes. 3. Will dipping a knife in hot water injure the temper? A. Not unless kept there a great length of time.

(18) S. & R. ask: 1. What kind of steel is best for knives for a spoke lathe cutting mostly dry oak timber? A. What is known as "chrome steel" will probably answer your purpose.

(19) L. A. R. writes: I have an iron pipe leading sirup from sugarhouse to refinery. The sirup is slightly acid, and is colored by its contact with the iron. It affects materially the quality of our sugars. The use of a copper pipe would obviate this trouble, but, besides the cost, I consider it unhealthy. What would you recommend? Is there such a thing as enameled pipe? If so, where can I find it? A. That copper is not generally believed to exercise any deleterious action upon sirup may be inferred from the fact of the vessels in some of the largest refineries being formed of that metal. We have seen one of Howard's patent vacuum pans eight feet in diameter, which consisted of a copper pan within which was a worm or coil of copper pipe through which steam was passed for boiling the juice; and in the SCIENTIFIC AMERICAN for November 27, 1880, will be found a description of Deeley's enormous vacuum pan, the coils of which are also formed of copper. Gun metal has also been used for the fittings and scoops in refineries. In some instances moulds of porous clay have been supplanted by others of iron coated either with varnish or glaze, or even painted with white lead paint. The iron pipe in question might be superseded with advantage by one of glazed earthenware or of wood; but the best conduit pipe would be one of iron coated with vitreous enamel of the same nature as the blue colored agate ware now becoming so generally employed for articles in culinary use.

(20) E. V. S. asks: Is there any special publication on potter's glass? A. One of the best and most comprehensive works on this subject is a "Treatise on the Origin, Progressive Improvement, and Present State of the Manufacture of Porcelain and Glass." It is published by Longmans, of London, England, but may easily be obtained through any bookseller.

(21) G. B. inquires: What is methylated spirit of wine? A receipt given to me contains this, and I cannot obtain it at any drug store in our city. A. It is ordinary alcohol adulterated with ten per cent of wood naphtha to prevent its being used for potable purposes, as, with a view to encourage the arts and manufactures, the English government permits it to be sold free of all excise duty. Any attempt to deodorize methylated spirits in that country subjects the experimentalist to severe penalties. Common alcohol may be employed for every purpose for which the methylated preparation is recommended.

(22) J. A. S. asks: 1. What is a gelatine mould for casting plaster ornaments composed of? A. Allow twelve ounces of gelatine to soak for a few hours in water until it has absorbed as much as it can, then apply heat, by which it will liquefy. If the mould is required to be elastic, add three ounces of treacle and mix well with the gelatine. If a little chrome alum (precise proportions are immaterial) be added to the gelatine it causes it to lose its property of being again dissolved in water. A saturated solution of bichromate of potash brushed over the surface of the mould, allowed to become dry and afterwards exposed to sunlight for a few minutes, renders the surface so hard as to be unaffected by moisture. 2. What change does calcined plaster undergo while setting? A. Calcined sulphate of lime, or plaster of Paris, when mixed with water, produces heat and hardens to a solid mass, slightly enlarging its bulk, hence its value in giving a sharp impression. The rapid hardening is explained by the anhydrous burnt sulphate of lime again chemically combining with as much water as it lost during the ignition. Had the heat at which the gypsum was calcined exceeded 320° Fah., it would have lost its affinity for water and consequently would not harden.

(23) L. S. H. asks: What kind of solution may be used by cigar makers to dip the leaves in to give the cigars an agreeable flavor? A. Ordinary cigars may be scented by moistening them with a strong tincture of cascarilla to which a little gum benzoin and storax is sometimes added; or the leaves which are to form the cigars may be soaked for a short time in a strong infusion of cascarilla, and then dried by a gentle heat. A small quantity of camphor, together with the oils of cassia and cloves, are by some added to the tincture mentioned.

(24) W. H. inquires: What is the solution sometimes employed by opticians to stain brass of a black color? A. A solution of chloride of platinum is the stain most commonly used for this purpose. A cheaper preparation is obtained by dissolving the black scales of iron of the blacksmith's forge (proto-sesquioxide of iron), in muriatic acid to saturation.

(25) C. F. A. asks: Is there not a wire screen that you can put to a window in a basement and look out into the street, but through which one cannot look into the room? A. Any wire screen formed with fine meshes will, if painted on the outside, fulfill these conditions. Finely perforated zinc is much employed for this purpose. These, together with flowered white muslin, prevent any one from seeing the interior of a room, while they present no serious barrier in the way of looking out through them.

(26) B. L. G. asks: 1. By what means can I obtain lead absolutely pure for chemical purposes? A. Reduce nitrate of lead with charcoal. The soft lead of commerce is in most instances sufficiently pure for every purpose. 2. How may I prepare chemically pure zinc? A. Granulate commercial zinc (which is seldom if ever pure) by melting and pouring into water, then place in a Hessian crucible with a fourth its weight of nitrate of potash; cover well and apply heat. After deflagration, remove the dross, melt the zinc, and pour into an ingot mould.

(27) R. O. asks how to make a hair dye like that used by barbers. A. Cleanse the hair with dilute ammonia water. Then moisten it uniformly with dilute solution of gallic acid or ammonium sulphide, and go over it with a comb moistened with solution of one part nitrate of silver in nine parts of water, touching the scalp as little as possible. Stains may be removed by applying a little dilute solution of iodine in iodide of potassium dissolved in water, and then with solution of sodium hyposulphite.

(28) L. W. D. asks: Do you know of any material or process by which a fine gloss, white finish, on wood can be obtained without the use of damar varnish? A. You might try spirit copal or shellac varnish, and polish down with pumice stone or rotten stone and oil.

(29) G. W. S. asks: 1. Are not blinds that are used on horses' bridles injurious to their eyes? A. We think not. 2. When Paris green is sprinkled on vegetables will the dew and air draw the poison out so that it will be less fatal if eaten? A. No.

(30) C. C. H.—The "oiled tissue" you send is goldbeater's skin, prepared from the peritoneal membrane of the cæcum, which, as soon as it is detached, is stretched and dried, soaked in a weak solution of potash, and stretched on a frame. While in this position a similar membrane is applied to it so that the surfaces which adhered to the muscular membrane of the intestine come together. They unite perfectly and soon dry. They are then glued to frames, washed with alum water, dried, washed with solution of isinglass in wine to which spices have been added, and varnished with white of egg.

(31) A. U. asks: 1. How are opals separated from the matrix? Are there any machines that can be used for that purpose? A. Consult Traill's "Treatise on Quartz and Opal." Emanuel's "Diamonds and Precious Stones," and Byrne's "Handbook for the Artisan." The latter contains a good article relative to the best methods and machinery for such work. Address the booksellers and dealers in machinery who advertise in this paper. 2. Is there likely to be a market for these stones in America? The specimens are very brilliant fire opals, and I have seen pieces two inches in diameter and half an inch thick. A. Yes.

(32) E. M. asks: 1. Can Jupiter's great spot be clearly seen with the telescope described in SUPPLEMENT, 252? A. Yes, when an achromatic objective is used.

(33) C. B. C. asks: How is chloride of silver made? A. Although it may be formed by the direct union of chlorine with silver the easier and better way is to dissolve chloride of sodium (common salt) in water in one vessel, and nitrate of silver in another, distilled water being used by preference for the latter. Now pour the one solution into the other, and instantly there will be formed a dense, white, curdy precipitate. Next pour off the supernatant fluid and add plain water two or three times to wash the chloride free from the traces of the nitrate of soda, the other product of the decomposition. The combining equivalent of nitrate of silver being 170, while that of chloride of sodium is 58·5, these proportions should be adhered to when dissolving the salts. The proportion of water is immaterial.

(34) L. B. F. wishes a receipt for making an acid-proof cement. A. It would have been desirable had particulars of the object for which it is required been given, as acids act so differently upon different substances. A mixture of equal parts of pitch, resin, and dried plaster of Paris is much used as a cement in chemical works where sulphuric acid is prepared. Troughs for holding acids may be effectively cemented by the following: Resin, 6 lb.; dried red ocher, 1 lb.; calcined plaster of Paris, ½ lb.; linseed oil, ¼ lb. These must be incorporated by well stirring together when melted. For smaller purposes an alcoholic solution of shellac, or a solution of bitumen in benzol, answers well. To render this latter less brittle, it is desirable to add a few drops of a solution of India-rubber. Marine glue also resists acids. It may be formed of India-rubber 1 part, digested, with heat, in a covered vessel containing 12 parts of mineral naphtha, to which, when solution is effected, 20 parts of powdered shellac are added. When liquefaction is complete pour out on a slab to solidify.

(35) J. R. S. writes requesting information respecting the recently introduced methods of obtaining reproductions of writing in inks of any desired color. A. Pour into a flat zinc trough, or upon a zinc plate having the edges turned up a quarter of an inch, a warm solution of the following substances: Water, 130 parts; sulphate of baryta, 75 parts; sugar, 30 parts; gelatine, 30 parts; glycerine, 180 parts. This mass when cool becomes stiff and forms the printing surface. The writing to be reproduced is written with any suitable ink, methyl violet being generally preferred; and this, when quite dry, is laid down upon the gelatine film and the hand rubbed over it. By this operation the ink is absorbed. Quite a number of impressions may now be obtained from this gelatinous surface, by laying upon it a sheet of paper and rubbing with the palm or edge of the hand. If the weather be very hot, to prevent the film from becoming sticky the proportion of baryta above given may be increased to 100 parts. By the following modification of this process the plate may be inked like a lithographic stone, and thus be made to yield an indefinite number of impressions in ink of any color. The proportion of water must be reduced, and the ink with which the writing or drawing is made must contain alum. On theoretical grounds the best ink to employ would be a saturated solution of the alum to which was added enough common writing ink to give it color. A wet sponge having been passed over the gelatine surface, the writing is laid down, and after the lapse of a few moments it is removed, when the writing will be found to be eaten into the film as if engraved. A roller charged with printer's ink is now passed over the surface, which, when properly inked, will now yield any required number of impressions. By preference the inking roller should be formed of India-rubber; fresh inking must be had recourse to after each impression has been taken.

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

H. R.—Barytocalcite—$BaCO_3+CaCO_3$.—J. S. W.—No. 1 is dolomite—magnesian limestone. No. 2, dathollte—a hydrated borosilicate of calcium.—M. B.—The gravel contains no metals. The bright particles are mica and a little iron sulphide pyrites. The rock is quartzose, carrying a little chalcopyrite—iron-copper sulphide.—P. S.—It is lead sulphide—galena; may contain a trace of silver.—J. P.—It is blast furnace scoria—not a native mineral.—W. T.—A sandstone saturated with petroleum.

COMMUNICATIONS RECEIVED.

On Inventors' Academy. By E. W. S.
On Railroad Rail Binding. By E. A. S.
On a Curious Icicle. By E. M.
On Rainfalls. By J. T. N.

NEW BOOKS AND PUBLICATIONS.

THE AMERICAN CHEMICAL JOURNAL.

The number for December contains several very able articles, among them the following papers: "Researches on the Complex Inorganic Acids," by Wolcott Gibbs. "Estimation of Alkaloids by Potassium Mercuric Iodide," by Albert B. Prescott. Contributions from the Chemical Laboratory of Harvard University: "On the Ethers of Uric Acid: Dimethyluric Acid," by H. B. Hill and C. F. Mabery. "Researches on the Substituted Benzyl Compounds: Ortnobrombenzyl Compounds," by C. Loring Jackson and J. Fleming White. "The Constitution of the Tartrates of Antimony," by F. W. Clarke and Helena Stallo. "On the Relative Stability of Certain Organic Salts," by Miles Beamer and F. W. Clarke. "Some New Salts of Uranium," by F. W. Clarke and Mary E. Owens. "Graphite from Ducktown, Tennessee," by W. I. Dudley and F. W. Clarke. "On the Distribution of Arsenic in the Human Body in a Case of Arsenical Poisoning," by S. W. Johnson and R. H. Chittenden. "Synthesis of Salicylic Acid," by Edgar F. Smith.

THEORIE DER GEWOELBE (THE THEORY OF VAULTS). By A. Foeppl. Leipsic: Arthur Felix, 1880. 152 pp.

This work is divided into four chapters, of which the first embraces the "Elementary Theory of Barrel Vaults," their conditions of stability, the graphical calculations for obtaining the pressure line, etc. The second chapter treats of the "Theories of Elasticities" in barrel vaults; the third chapter is devoted to the theory of the pressure and elasticity in domes; whereas the fourth treats of groined arches. This work was not intended for the beginner, as it requires considerable acquaintance with the subject; but for such persons it will be found to be of great value, as it contains a large store of information, especially in regard to modern developments and the elasticity of vaults.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

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

December 21, 1880,

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 one dollar. In ordering please state the number and date of the patent desired and remit to Munn & Co., 37 Park Row, New York city. 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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Aging and purifying spirituous liquors, apparatus for, F. L. Wood ... 235,840
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Boilers, composition for preventing incrustation of, H. Heimann ... 235,633
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Bung, faucet, Reynolds & Shaw ... 235,653
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Car wheel, A. Wilbur ... 235,835
Carriage body loops, device for making, W. Pearce ... 235,806
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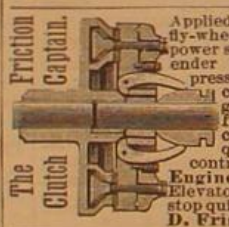

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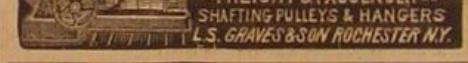

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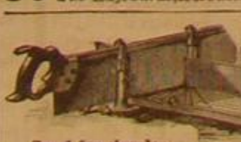

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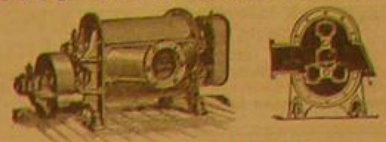

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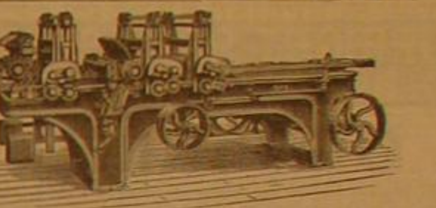

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