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## THE MANUFACTURE OF AGGLOMERATED FUEL.

The direct utilization of refuse coal in the production of heat is a problem which still awaits a solution, but the indirect utilization of it has for a long time been an accomplished fact, and the manufacture that it has given rise to now constitutes a prosperous industry whose present state in France we propose to make known. The idea of converting refuse coal into bricks is due to Mr. Marsais, an engineer, and it was from the Chaleassiere Works, which are at present constructing all the *materiel* necessary for the manufacture of agglomerated fuel, that came the first truly practical press, devised by Messrs. Revollier & Marsais. This press, which was in the first place hydraulic, has been employed in a certain number of large industrial establishments. It has since been improved by Mr. Couffinhal, and has become exclusively mechanical.

The manufacture of coal bricks is, in principle, exceedingly simple. It consists in forming a paste with coal dross and pitch, passing it through a pug mill in order to mix it thoroughly, and then compressing it strongly in a hydraulic or mechanical press, which solidifies the agglomerate and gives it a form convenient for handling and storage.

We shall first examine the double compression machine (Fig. 1), and afterward have a few words to say regarding the manufacture of the paste.

The machine is set in motion by a horizontal shaft—either the driving shaft of any motor whatever or an intermediate one. This first shaft, through the intermedium of a pinion, actuates gear wheels keyed at the end of two shafts that are placed symmetrically with respect to the principal axis of the machine. These shafts are provided at the other extremities with cranks that actuate two vertical connecting rods that may be seen in front in Fig. 2 These connecting rods are attached to a horizontal cross-head that transmits alternate up and down motions to two working beams, which are situated above the mould table, and which actuate the upper moulding piston and the lower piston. The lower piston that empties the moulds is actuated by a second pair of working beams underneath the mould tables. When a compression is being effected through the descent of the working beams and moulding pistons over the table, there comes a period when the upper part of the brick ceases to descend, through the resistance that is offered by the lower piston, and also because of the friction that the coal experiences against the sides of the mould. At this instant the lower surface, being less pressed than the upper, a reaction occurs, and the lower surface becomes a fixed point, and the lower piston acts in its turn until the pressure has become the same on both sides. This mechanism recalls that of a nut-cracker, and it could not be simpler than it is.

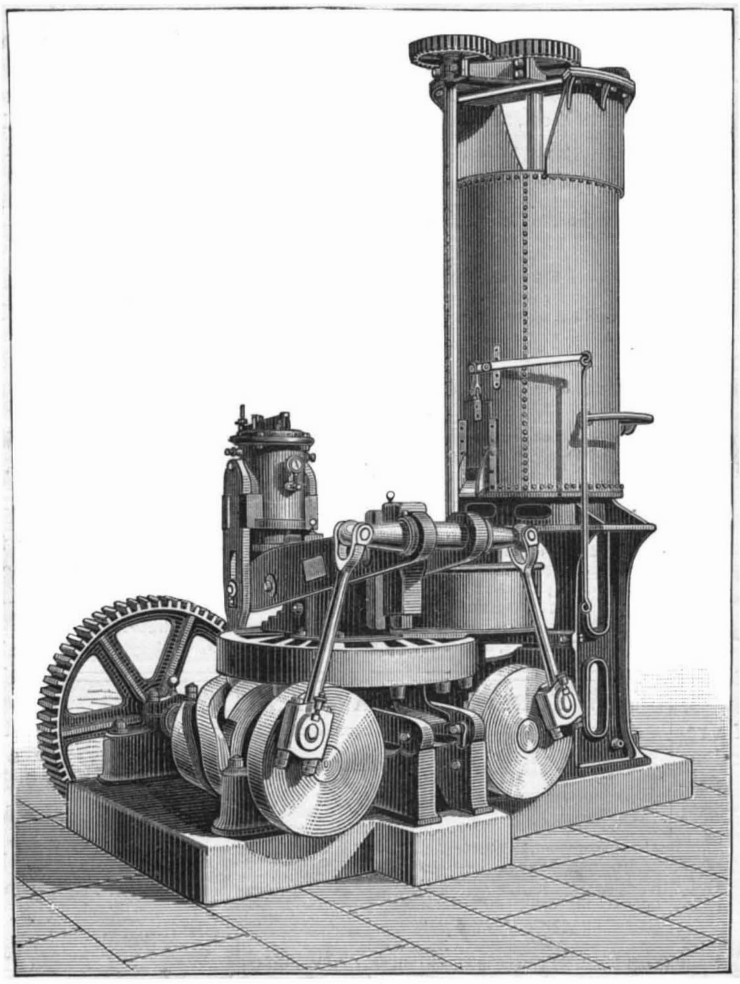

Fig. 1.—PRESSING MACHINE FOR ARTIFICIAL FUEL.

In order to obtain a good product, it is indispensable that the increase in the compressing stress shall be suspended when the resistance reaches a given limit through the quality of the coal to be treated. To effect this, it became necessary to give the parts of the machine a sort of elasticity. So the action of the levers is not transmitted directly to the compressing plates, but through the intermedium of a hydraulic cylinder that permits of making the pressure upon the bricks regular. This cylinder, which is affixed firmly to the frame, carries two valves, one of which opens inwardly and the other outwardly. If, during the compression, the moulding cylinder meets with a resistance greater than the proportional support that the water in the cylinder (retained by a spring valve) can give it, the valve rises, the water escapes, and the working beam continues its motion without any increase in the pressure exerted upon the brick. When the dead center of the crank is passed, the entire system descends through its own weight, and the water that has escaped through the valve is sucked up and fills

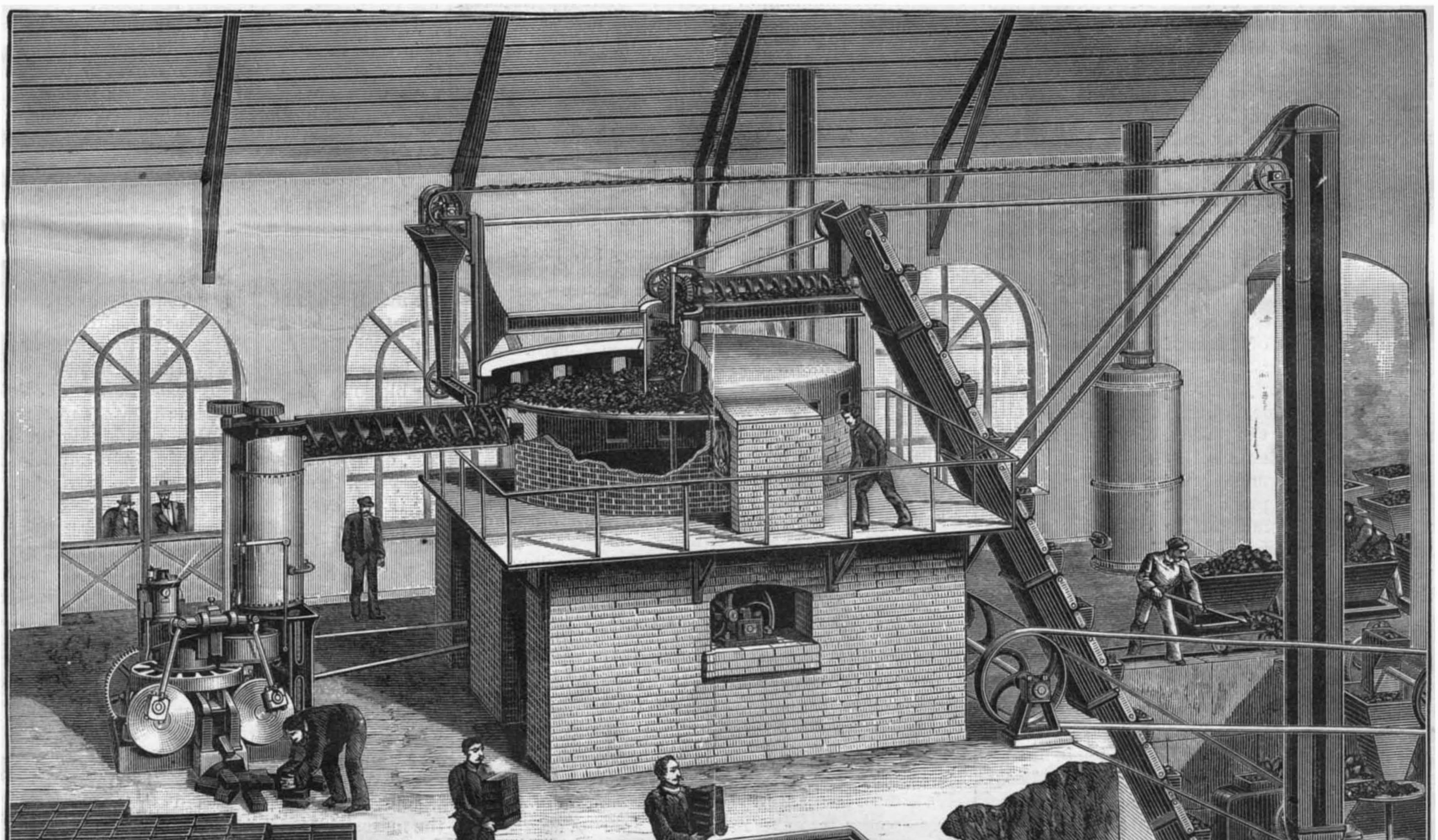

Fig. 2.—THE MANUFACTURE OF ARTIFICIAL FUEL.—DRYING, GRINDING, AND PRESSING.

the cylinder again in passing through the second valve arranged for the purpose.

A hydraulic gauge, placed at the side of the cylinder, permits of regulating the pressure by acting upon the spring of the exhaust valve. The compression is effected within three distinct periods: in the first, the upper compressor acts alone; in the second, the lower one rises until the pressure is equal upon both surfaces; in the third, when the limit of pressure is reached, the piston continues its motion in the hydraulic cylinder until the dead center of the crank is passed.

The moulds are emptied upon a tilting table or endless belt, or even directly upon the floor in cases where carts can be driven into the works.

The table carries from 12 to 14 moulds, which are so arranged as to give the bricks a form such that their height and breadth are half their length. They can then be piled up crosswise, so that four of them form a perfect cube and waste no space. There are four styles of double compression presses that yield bricks of 1, 2, 5, and 10 kilogrammes, and manufacture, respectively, 18, 50, 90, and 150 tons of bricks per day.

This system of double compression presents numerous advantages, the most important of which is the greater degree of homogeneousness, and consequently greater solidity, obtained. In the old machines, the density of the bricks, as a consequence of the friction of the coal against the moulds, continued to diminish from the surface in contact with the compressing cylinder to the one most distant from it. With double compression, the least dense part is found in the center; the edges are entire and sharp, and waste is, through this fact, notably diminished.

The paste for manufacturing the bricks was formerly prepared by means of a steam pug mill; but this is now replaced by a special furnace that heats directly and has a revolving sole. The apparatus may be seen in the center of Fig. 2. The paste consists of a mixture of coal and pitch, that must be as intimate as possible in order that its agglomeration may be afterward effected in the press.

The furnace is circular in shape, and consists of a revolving cast iron platform whose motion is dependent upon that of the agglomerating machine. This platform is surrounded with masonry, which is inclosed within an iron plate jacket, and which supports a spherical dome that is traversed in its center by a cylinder that carries an axle provided with paddles. It is into this cylinder that is emptied the mixture to be prepared. A lateral fireplace, with two opposite doors, permits of obtaining the heat necessary for the elimination of the water, for heating the coal, and for melting the pitch. The flames, after licking the upper surface of the mixture, heat the dome (which reflects them), pass beneath the sole, opposite the fireplace, and from thence, through a flue, to the chimney. In the circumference of the furnace jacket there are six apertures. The first four of these serve for the introduction of scrapers that turn over the material, and mix it up, so as to permit it to become heated uniformly and to present all its parts to the flames and the sole. Opposite the fifth aperture there are two bars, one fixed and the other movable, which, through the aid of hinged partitions that may be inclined more or less, gradually carry the material from the center to the circumference, while at the same time turning it over and stirring it up just as the scrapers do. Another object of this arrangement is to regulate the thickness of the layer, and, consequently, the time during which the mixture remains upon the sole.

Another scraper, maneuvered by means of a rod exterior to the furnace, acts upon the material in the center, moves it to the zone of action of the preceding ones, and regulates the delivery. The sixth aperture serves for the exit of the properly heated paste.

The furnace, as a whole, is built upon masonry that contains an opening for the passage of the shaft and for the gearings that actuate the sole.

The revolving sole furnace operates continuously, as does the agglomerating press. The coal is well dried therein, an essential condition for obtaining a good product; and the temperature to which it is submitted softens it a little and increases its agglutinative properties, this being followed by a considerable saving in pitch.

The engraving that gives a general view permits one to obtain an exact idea of the mode of manufacture. The refuse and pitch, coming in on the right, pass through the breaking and proportioning apparatus, and the coal is then carried by chain and buckets to the sole of the furnace, to be dried, and the pitch to an endless screw, where it mixes with the dry and heated coal. The mixture thus begun in the endless screw becomes more intimate in the pug mill stationed above the press. The bricks, upon coming from the latter, are piled up, or are loaded on carts and carried away.—*La Nature.*

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IN small blasts, 1 pound of powder will loosen about 4½ tons; in large blasts, 1 pound of powder will loosen about 2¾ tons. One man can bore, with a bit 1 inch in diameter, from 50 inches to 100 inches per day of 10 hours in granite, or 300 inches to 400 inches per day in limestone.

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**IMPROVED METHODS.**

So wedded are workmen, generally, to familiar methods that even a demonstration of a better way of doing a job is not always convincing. A sub-contractor in a machine shop took certain parts of the work on machine tools to do by the job. He was a stickler for old methods, and did not "take stock" in the kindly meant suggestions of the superintendent, who was disposed to aid him. At last, however, he yielded so far as to allow the superintendent to "fit up" for one job, with the understanding that if the output did not promise to pay, the contractor should bear no expense. The job was the finishing of "ball nuts," so called, nuts to be turned up by hand, and consisting of a central boss for the thread and two short arms ending in balls. The contractor's method was to center each end, drill centers, and turn and finish each ball in the lathe. Then the nut was chucked, and the central cylindrical portion was drilled and tapped. A threaded arbor was then fitted and mounted on centers, and properly dogged on the table of a crank planer or pillar shaper; and so the two sides of the nut and the arms were dressed by the reciprocating motion of the cutter. The arbor was then swung in a lathe, and the ends of the cylindrical threaded portion and the edges of the arms squared up. It will be seen that this was a roundabout way to complete a simple job; indeed, the machine work on the crank planer was slower than hand filing would have been.

The superintendent improved on these methods very sensibly. He chucked the piece, drilled the center hole, and tapped it. Before removing it from the chuck he finished, by turning, the face of the central portion and the edges of the arms. Then he screwed in a threaded arbor, reversed ends, either in the same lathe or another, and repeated the turning for the other face. While still on the arbor, it was placed on centers on a milling machine, and passed under a gang of milling tools adapted to the profile of the cylindrical portion and the arms; the work was half revolved on the centers, and the job repeated. Nothing now was left to be done but finishing the balls. This was done in a peculiar way. On the two ends of a polishing spindle were mounted hollowed out emery wheels with rests in front. The piece was held, first one end or ball, and then the other, inside the concavity, and slowly turned. The ball was cleaned, scoured, and shaped in the wheel of coarse emery on one end of the spindle, and then was finished and polished in the finer wheel at the other end. In all this work there has been no centering, no lathe turning, no slow planing on the pillar shaper, and the amount of handling was greatly reduced from the old method. But the crucial test was the economic result: a saving of two-thirds of the time, and even more, for five completed pieces were turned out within the time required by the old method to complete three pieces. The contractor was convinced, and bought the plant.

This single specimen of improvement in methods might be supplemented by instances in the recollection, if not in the practice, of many mechanics. It pays to use wit and judgment, as well as skill and handy manipulation, in the conduct of work.

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**DROPPING AND STRIKING UP.**

There has been great improvement on the old style machines for cutting and heading tacks and nails and forming rivets; the heading machine has been adapted to forging purposes with great advantage. But the limit of the machine is not great; a requisite to accurate work, unless with the result of great strain to the machine, and its final disabling, is that the amount of material fed in for working should be accurately measured. All the blows of the heading machine are absolute as to force and exact as to distance; they are made by means of a crank or an eccentric acting directly on the hammer, or by similar means acting on a knuckle or "toggle" joint; in either case there is no provision for yielding in the event of a superabundance of material to work upon; the material must give, or "get," or the machine must stop or break. So it is necessary that the feed of the heading machine shall be exact as well as accurate; it must not "bite off more than it can chew."

But the drop has plenty of leeway, limited only by the accommodation of the dies, and they are made so as to allow plenty of room for sprues, or overplus of metal. The force of the blow of the drop is graduated by the weight of the hammer and the distance through which it falls, the latter element being changed at will. The limit of the blow is simply the resistance of the material to be worked to the impact of the falling weight. This force varies in effect by the condition of the material; if soft and plastic, at nearly a white heat, it yields as readily as soft putty; if only dull red, it resists impact, and works hard. So, also, the quality of the material adapts itself to the blow of the drop.

From the above it is easy to see that the drop has a much larger range of useful work before it than the heading machine; the latter may work faster and be more exact in its first results; but the drop can be adapted to a much more varied list of articles. At all events, the heading machine can never usurp its place.

### An Incident of the Late Philadelphia Exhibition.

A rather good practical joke was played on one of the exhibitors of the Philadelphia Electrical Exhibition by a representative of the SCIENTIFIC AMERICAN, who was making some sketches for publication. While this gentleman was putting the finishing touches on one of his drawings, his attention was directed to a crowd of sightseers, who were collected about one of the hand electrical machines where shocks were administered to the curious. Three or four would join hands, and after the "end men" had taken the poles of the battery in their hands, the operator would rotate the wheel and administer shocks of gradually increasing severity.

Occasionally curiosity would be excited in the breast of some innocent, and as soon as he had given himself up to the influence, the operator would generate a high current, taking advantage of his inability to let go of the handles, and would very soon have him dancing to any tune he was inclined to whistle.

This sport was very amusing to the spectators, and especially so to the showman. Our artist, after watching several experiments of the nature described, became filled with sympathy, and determined, if possible, to turn the ridicule to the other side of the table.

He soon provided himself with a piece of copper wire, which he passed down his sleeves under his coat, and which he made of such length as to terminate in the palms of his hands. Thus equipped he strolled leisurely to the center of interest, where he found a new subject dancing a Highland fling without any special invitation from anybody. As soon as the unfortunate had been released, our friend stepped before the instrument, and, muttering something about his being very fond of electricity, took hold of the handles, taking good care, however, that the ends of the wires should be brought in close contact with the poles in each hand. Thus prepared, he bade the tormenter begin. The wheel began slowly to revolve, and a good current was very soon indicated, but our hero stood it like a Spartan, and showed no signs of discomposure. The greater the current, the more he seemed to like it. The spectators could hardly believe their eyes, and the operator's amazement and anger could only find vent on the poor wheel, now flying at its fullest speed and generating a current strong enough to kill any man. An occasional voluntary shake of the arms on the part of Mr. Artist further increased the deception. Finally the latter requested to be released, whereupon Mr. Showman stopped the wheel and accused him of holding insulators in his hand, which he quickly disproved by opening his palms and raising his arms, which latter act served to pull the wire out of sight under his sleeve. He then turned on his heel, and as he approached the gaping crowd was received with that absence of elbowing which might characterize the reception of an uninvited visitor from the nethermost world.

### How Shot are Made.

Every person who has walked about the lower part of this city, says the New York *Tribune*, must have noticed a high round tower, as high as the roadway of the Bridge, which rears itself high above the surrounding buildings and has small windows at different places. This tower is in Center Street near Worth Street, and belongs to the Colwell Lead Company. There are several of these towers in this city. They are places built especially for the casting and manufacture of shot. The tower rises to a height of 176 feet, and is fifty feet in diameter at the base. It diminishes in diameter as it ascends, being about thirty feet across at the top. It is divided into several stories. A circular stairway made of iron extends to the summit, giving access to the several stories. Great height is essential for casting, as the lead must cool in the descent, and thus assume a spherical shape. If hot, it would flatten when it strikes the water into which it falls.

The first method is making what is called "temper." This is a mixture of arsenic and lead. The mixture is melted in large kettles, and is constantly skimmed and stirred. It is cast in bars, the same as lead. When the temper is made it is carried to the top floor, where there are kettles and a furnace for melting it. The temper is mixed with the lead, as pure lead would assume various shapes in casting; but when mixed with the temper in the proportion of three tons of lead to one ton of temper, it takes the shape of globules when it is cast.

The casting pans are large colanders, round pans with holes perforated in the bottom. The casting is all done on the top floor, and the colander is suspended over an opening in the floor, which goes through the entire height of the building to the ground, where there is a well of water. The lead is melted in large kettles, and is dipped out and poured into the colander with ladles which have long handles. It oozes through the holes in the bottom of the colander, and falls through the opening to the ground floor into the well. The shot is taken out of the well by small buckets fastened to an endless belt, which runs over a wheel, which carries it from the well up to a long hot metal table. Here the shot is constantly stirred by men with long rakes, and the heat rapidly dispels the moisture, and the shot soon becomes perfectly dry.

It is taken from the "drying table" to the "screeners," a series of tables with narrow openings between them, the tables being set at a slight angle. If the shot is round and perfect, it rolls rapidly along these tables, skipping the openings, until it reaches a box at the extreme end, into which it falls. If it is imperfect, it cannot roll fast, and falls into the openings, under which boxes are placed.

The shot then goes to the "separators," which are a series of drawers, not unlike a bureau, which rocks backward and forward by machinery. The shot is poured into the upper drawer, which has an iron bottom perforated with holes of a certain size. The second drawer has holes of a smaller size, and so on down to the lowest drawer, the bottom of each drawer being perforated with holes of a size smaller than those in the drawer above it. The backward and forward motion throws the shot from side to side, letting all the shot the size of the holes or smaller pass through into the second drawer, while all larger than the holes remain in the drawer. The same is repeated down to the lowest drawer, so that each drawer contains a smaller size of shot than the one immediately above it.

The next process is "polishing." The shot is put into irregular shaped iron boxes, which continually revolve. When the box is nearly full, powdered black lead is put in. The irregular motion of the box throws the shot from side to side, and the black lead is so ground into it that it cannot be rubbed off. And it is this that gives it the beautiful shiny appearance.

### Bolton Flagging.

Sixteen miles east of Hartford, Conn., in the town of Bolton, is a quarry of remarkable stone, not duplicated in its qualities by any other in this country. The stone is a micaceous slate, but is so thoroughly filled with mica that the slaty matrix is barely discernible by the eye. The best qualities of this stone are not affected by moisture and frosts, are not corroded by acids nor stained by oils, and a slab of it will bend perceptibly before it breaks. As a pavement, its durable quality is also remarkable; there are flags of it on a busy street in Hartford that have been trodden for more than fifty years, and are in good condition now. This stone is in great demand for floors and tables for chemical factories and laboratories, for hospitals, and in public buildings where constant cleanliness is a requisite. The area of these flags is limited; very seldom is one quarried with a superfices of two hundred square feet.

The quarries are in the mountains known locally as the "Bolton Range," and forming the eastern boundary of the Connecticut River valley. They are at an elevation of about 1,000 feet above the level of the Connecticut River, and are of considerable antiquity, having been worked continuously for more than sixty years. In 1820, flags of this stone were sent to Washington, Philadelphia, Baltimore, and to New Orleans. At the first, the quarrying was largely done by means of gunpowder; but this destroyed more than was gotten out in a marketable condition. Now gunpowder is used only to remove the superincumbent rock to make the ledge bare; all the slabs are taken out by the use of crowbar and wedge. The ledge has been traced for more than six miles, but much of it is valueless because of the cost of getting out the stone, the layers being at an angle, so that the surface rock may be reached in one place at a depth of less than six feet, but within one hundred feet surface distance it will be sixty feet below the soil. The rock is split into slabs only where natural divisions occur; some slabs may be only half an inch thick, while others are five inches, and as they are they must remain, for no chiseling can effect another division. Indeed, the only means of dressing the stone is by hammering, the edges being dressed in this way; the surfaces remain in their natural state, smooth and glistening. These natural divisions may be traced by the eye, sometimes entirely around a block, and where the minute crack appears, rows of thin iron wedges are inserted and gently forced in by hammers until one lamina can be lifted from the rest like the well-baked upper crust of a pie.

### Compressed Air in Birmingham.

A very remarkable kind of public meeting was lately held in Birmingham—a meeting which seems at first glance to be without precedent. It was called by the promoters of the Birmingham Compressed Air Power Company, who have obtained an act of Parliament for the distribution, for manufacturing purposes, over a considerable area of the town of Birmingham, of air strongly compressed at a central station. The Town Council have accorded their moral support to the scheme, after receiving favorable reports from Sir F. J. Bramwell and Mr. Henry J. T. Piercy; and the object of calling the recent meeting was, says the *Journal of Gas Lighting*, to explain fully the nature and extent of the proposed undertaking to such of the inhabitants of the borough as might be interested in the scheme, either as future consumers or as investors.

The meeting seems to have been very successful in every way. Several experts spoke simply and practically in support of the scheme; and if an intelligent audience of power users—thoroughly alive to everything that might improve their pecuniary interests—cannot be got together in Birmingham, it is very difficult to imagine where such an assembly could be collected. Judging from the report of the proceedings, the scheme was thoroughly examined from every point of view, and unanimously approved of on grounds of economy, safety, and cleanliness. All that now remains, therefore, is for the company to get to work and prove that they can earn a dividend. This they are confident of being able to secure; and if their anticipations should be realized, there is no possible reason why the consequential public benefits which they promise to the town should not be forthcoming. It is a most interesting experiment, and will attract a great deal of attention from other manufacturing communities.

In New York and some other cities we distribute hot steam from a central station, the circulating pipes extending in the aggregate for many miles underground. There is no reason why compressed air should not be so conveyed, and thus furnish power to run elevators and engines, large and small.

### Fireless Tramway Engines.

The system of tramway haulage by fireless locomotives has been tried on a very considerable scale in Batavia, and has given so much satisfaction that it is contemplated to extend it. The Batavia Steam Tramway Company, says *Engineering*, owns a line divided into two portions: the first, from Batavia to Kramat, having a length of 8 kilometers (5 miles) laid with a double track of Demerbe grooved rails, and the second from Kramat to Muster Cornelis, having a length of 4½ kilometers of single track of Vignolles rails. The first piece is almost level, with the exception of short inclines of 1 in 32 over bridges; there are two long curves and a number of short ones of 30 meters radius. The second section has a continuous gradient of 1 in 450. The haulage is effected by 21 fireless Lamm Francq locomotives and five stationary boilers, the whole of which were manufactured by the Hohenzollern Locomotive Works, Dusseldorf. Two of the boilers are situated at Batavia, and three at Kramat, but one only is in work at each station at a time, the remainder being in reserve.

They are worked 12 hours a day, and fill an engine every 1½ minutes during about three hours in the day, and every 10 minutes at other times. An engine charged to a pressure of 12 atmospheres (180 lb. per sq. inch) will draw two or three passenger cars from Batavia to Kramat, and from Kramat to Cornelis, up and down again to Kramat. Part of the line was opened in July, 1883, and from the last annual report it appears that the cost of haulage amounted last year to 23 cents per kilometer (7·4*d.* per mile), composed of the following items:

| | Cents. |
|---|---|
| Driving engines | 4·7 |
| Heating boilers | 2·3 |
| Coals | 14·0 |
| Packing, lubricating, etc | 2·0 |
| Total | 23·0 |

(5 cents equal 1 penny.)

More recently the cost of haulage has been only 17 cents per kilo (5·24*d.* per mile), the price of coal being 2*l.* per ton. The consumption of fuel was at first 6 kilogrammes per kilometer (21·3 lb. per mile), but recently it has fallen to two-thirds of that amount. Repairs of boilers and engines have cost 2 cents per kilometer, and have consisted chiefly in returning the wheel tires and renewing the felt on the boilers. Since the road has been completed, the receipts per month have amounted to 22,800 florins, and the total expenditure to 12,800 florins, leaving a net monthly profit of 10,000 florins (800*l.*). The fare is 2½*d.* for a four mile run, or any part of it. The engines give every satis faction. They are in native hands, and run constantly, with little attention and no breakdowns. Two more have been ordered, and will be shipped from Amsterdam this month. It is believed that with a better road the expenses might be reduced to 50 per cent.

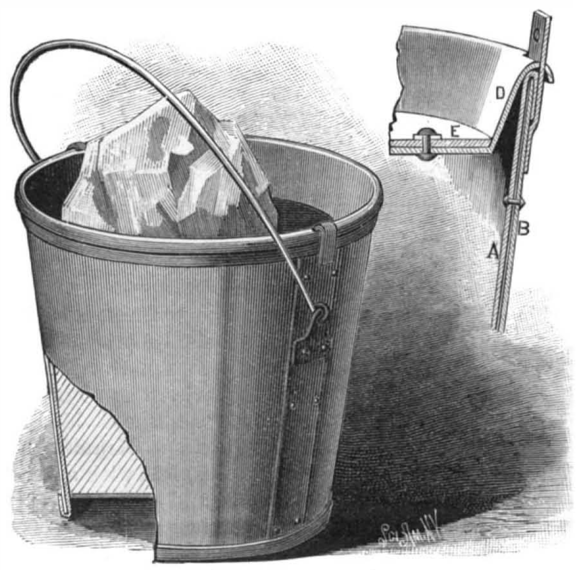
### Professor William Wagner.

The founder of the Wagner Free Institute of Science in Philadelphia died at his home in the latter city Jan. 17, at the great age of 96 years. He was an apprentice of Stephen Girard, but in 1835 retired from business with an ample fortune, and turned his attention to scientific subjects, founding the institution which has since borne his name. In October last we called attention to the work that Prof. Wagner was doing for the promotion of the education of young people, and at that time it was thought that his gifts to the institute had amounted to $600,000, while his will now leaves all his property thereto. Prof. Wagner retained his faculties to the last, his death not being attributed to any special disease, but to the gradual wearing out of the vital powers.

RECENT excavations at Worms, Germany, brought to light about 1,300 feet of Roman pavement and a large number of objects of great interest, including some which afford a hint to manufacturers, namely, pieces for playing a game such as draughts, made of glass.

BUTTER TUB.

The pail is made of tinned sheet iron provided on the outside with a covering of wood pulp or building paper, held on by bending the top and bottom edges of the metal over the edges of the covering sheet. The metal bottom is placed a short distance above the lower edge, so as to permit the cool air to pass beneath. The joints of the paper may be covered by one or more metal strips, B, secured by rivets. Ears are riveted to the strips to hold the bail. The cover is formed with a flange, D, which is so bent as to fit on the upper edge



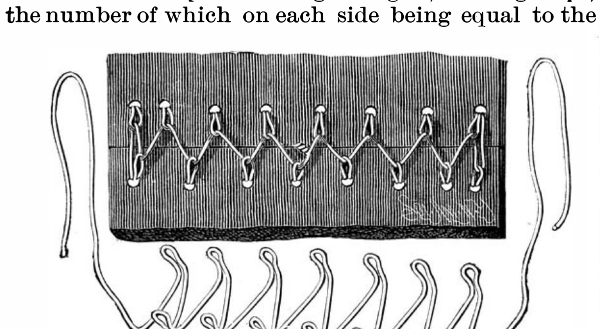
McADAM'S BUTTER TUB.

of the tub. Ice can be placed in the cover to keep the butter fresh and cool. A sheet of building paper, E, is riveted to the upper surface of the lid. The bent part of the flange of the cover is formed with a series of slots, through which metal tongues, C, are passed and then bent down to the outside to hold the cover on; the tongues are riveted or otherwise secured to the tub. The sheets of paper form a very perfect non-conductor of heat, and protect the contents of the pail from atmospheric influences.

Further particulars can be obtained by addressing the inventor, Mr. James McAdam, of Postville, Iowa.

BELT FASTENER.

The fastening is made of wire, which for about half its length is bent into a series of zigzags the angles of which are bent upward at right angles, forming loops, the number of which on each side being equal to the



KELLS' BELT FASTENER.

number of holes in each end of the belt. The holes are made at such a distance from the ends of the belt that when they are brought together the holes will be at the same distance apart as the rows of loops in the wire. In using the fastening, the ends of the belt are brought together, and the ends of the wire are passed through the holes in such a direction as to bring the zigzags on the inner side of the belt. The ends of the wire are then passed through the loops successively, forming a second series of zigzags upon the outside of the belt, and are twisted together, as shown in the engraving. In use, the fastening beds itself in the belt so as to leave the surface smooth. The fastener is easily applied, and reliable in use.

This invention has been patented by Mr. Thomas Kells, of 119 Freeman Street. Greenpoint, Brooklyn, N. Y.

**Sugar Made from Potatoes by Electricity.**

Although glucose can be easily prepared from various amylaceous substances, all attempts to artificially produce saccharose or cane sugar have hitherto been unsuccessful, but it is now announced that the synthesis of saccharose has just been accomplished by Messrs. Aubert and Giraud, and it is naturally anticipated that the discovery may eventually be of vast importance to the sugar industry. The process consisted essentially in submitting amylaceous matter derived from the potato, after it has been converted into glucose in the usual manner, to the action of an electric current equal to about 75 volts. The electrodes were immersed in the solution, and the current reversed from time to time. The reaction terminated in about two hours, and the finish was indicated by the liquid no longer giving the characteristic color with tincture of iodine or a precipitate with alcohol. The liquid was afterward defecated by means of lime, which was subsequently removed by carbonic anhydride, and the sirup was then decolorized and left to crystallize. The crystallized product upon analysis yielded 88·38 of saccharose, 1 per cent of glucose, 3·67 per cent of ash, and 6·95 per cent of water; it was, therefore, far from being pure cane sugar. At present it has not been decided whether the reaction consists in the dehydration of glucose, the union of a molecule of dextrine with one of glucose, or the hydration of dextrine.

**Progress of the Lick Observatory.**

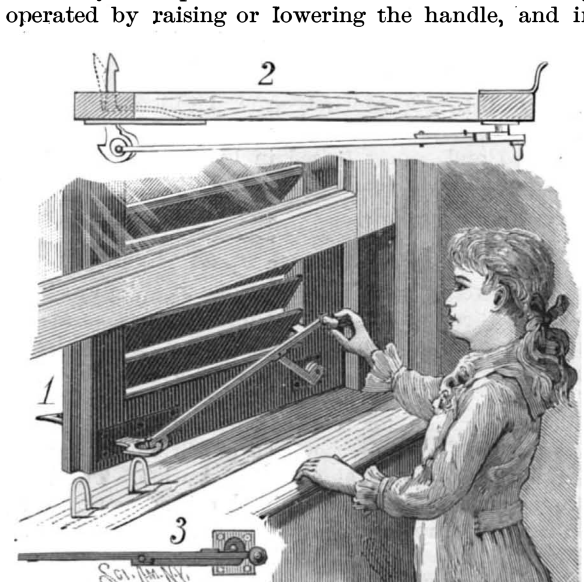
The trustees of the Lick fund have already provided one of the most complete observatories in the world, although the great 36-inch refractor, which is to be its leading feature, is not yet built. The observatory is on Mount Hamilton, about 4,250 feet above sea level, and has a meridian circle which Prof. Holden thinks one of the most perfect of its class. The flint disk for the great equatorial was completed long ago, but it has as yet been impossible to obtain a crown disk. After nineteen unsuccessful attempts, two have been recently cast in Paris, and Mr. Clark, of the firm of Alvan Clark & Sons, visited Europe recently for the purpose of examining them, but reports that both of them were defective. If these glasses had been perfect, it would have taken eighteen months to have ground and finished them. Already the observatory possesses a 12-inch equatorial, a 4-inch transit, a comet seeker, a vertical circle, and a 6-inch equatorial. There are five clocks connected by a complete electrical system.

Thomas E. Fraser, superintendent of the observatory, states that the 36-inch glass, when finished, will be by far the most powerful one in the world, bringing the moon within thirty miles of the earth, whereas eighty miles is the limit of existing telescopes.

Superintendent Fraser states that since records of the temperature have been kept on Mount Hamilton, winters have been growing colder. The lowest point reached during 1881 was 19° above zero; the next year, 17°; the next, 15°; and last season, 13°. Thus far this season the lowest temperature has been 22°.

IMPROVED SHUTTER WORKER.

The shutter worker, by means of which the shutter may be readily opened or closed, and locked in either position, is applied to the inside face of the lower rail of the shutter. The rocking spring catch is of any approved construction, and is formed with reverse spurs at its opposite ends for engagement with fixed staples to hold the blind both when closed and opened. This catch is placed near the opening edge of the shutter, thereby relieving the latter of strain on its hinges, and keeping it more securely closed in a high wind. The device for working the catch consists of two rods, the longer of which extends nearly the full width of the shutter, and is connected at its forward end with the catch; the other end is provided with a handle and also with an inner laterally-projecting lip. The other rod is pivoted near the hinge edge of the lower rail, and its free end is pivoted to the long rod in advance of its lip, which occupies a position over the short rod between its two pivots. That end of the short rod secured to the shutter is pivoted in a position slightly above the horizontal plane in which the catch moves, and the rods are so arranged that when lowered the long one will drop below the end pivot and below the level of the catch, until stopped by the lip resting on the short rod, so that when the shutter is closed it will be held locked by the dip of the rods. The catch can be easily operated by raising or lowering the handle, and in



BROWN'S IMPROVED SHUTTER WORKER.

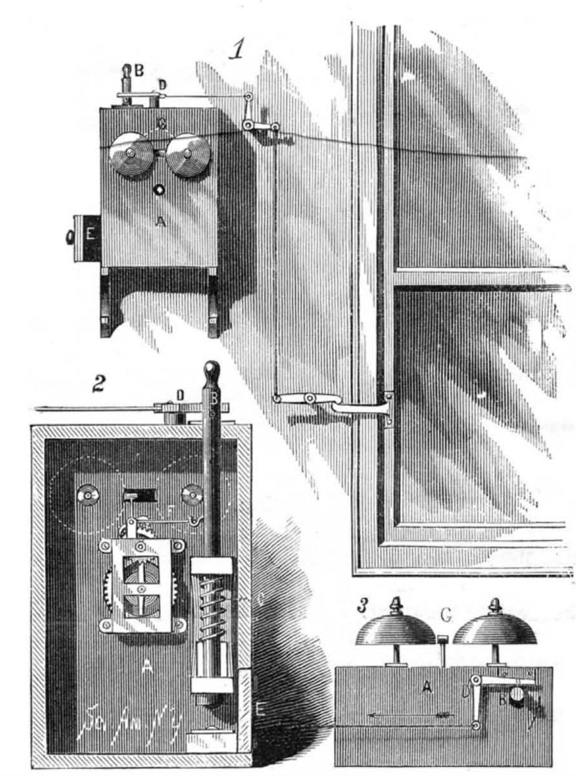
opening and closing the blind there will be no necessity to but very slightly open the window, and never any necessity to lean out of the window.

This invention has been patented by Mr. Robert I. Brown, of 35 West 130th Street, New York city.

BURGLAR ALARM.

The engraving represents an improved burglar alarm which rings a bell and fires a cap or cartridge when the alarm is released; the device can be connected with any desired number of doors, windows, etc. On the outside of the box, A, are two bells, between which is a hammer arranged to be operated by a clock work in the box. On the inner end of the hammer is an arm having a hook in its free end, which receives a hook projecting from a hammer rod, B, which moves vertically in guides on the inner sides of the box. The rod is pressed downward by a spiral spring, C. On the bottom of the box and below the rod is placed a firing block to receive the caps, the inside of the box being reached through the door, E. The upper end of the rod passes through a slot in the top of box. Pivoted on top of the box is an elbow lever, D, which is connected by wires and intermediate elbow levers with one end of a lever pivoted to the wall near the window, so that the outer end of the lever can be tripped by an arm on the sash.

The alarm is set by pulling the rod upward, when it will be held by a pin projecting from its upper end resting on top of the box at one end of the slot. A cap is placed on the block, and the arm of the clock work is engaged with the hook on the rod. If the window is opened, the wires connected with the elbow lever,



SIMS & SHORKES' BURGLAR ALARM.

D, will be pulled, thereby pushing the rod from the edge on which its pin rests. The spring will force the rod down to explode the cap, and the clock work being released will operate the hammer to sound the bells.

Further particulars regarding this invention can be obtained from the inventors, Messrs. J. C. Sims and F. R. Shorkes, P. O. Box 255, Maynard, Mass.

**On the Canning of Fish, Etc.**

An esteemed correspondent, writing from British Columbia, says:

Noticing your reply to a correspondent about canned goods, I (this morning) opened several cans of salmon that were processed in July of 1879, 1880, and 1881, and on comparing them with last season's cans found it impossible to detect the slightest difference. I hold that if a can is once perfectly sealed, the contents will remain unaltered as long as the metal casing remains intact. A can will keep if every portion of the contents has been subjected to a temperature of 212° Fah., whether the air is expelled or not, as my experiments have conclusively proved.

When I first began the business, I was taught that the air unless expelled would cause the contents to deteriorate, and that was the reason the cans were vented.

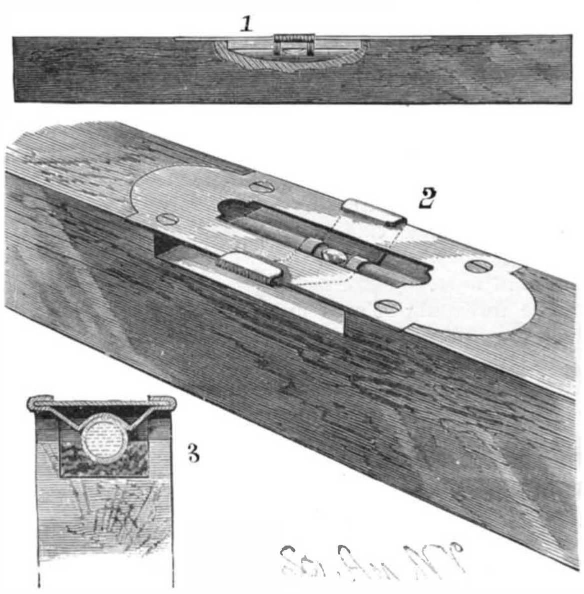
I soon found that it was a mistake. The venting is done for the purpose of testing for leaks. A tight can has a sound that cannot be mistaken for a leaky one.

If your correspondent boils his fish, flesh, or fowl with the vents open, he will have dry cans for his pains. The vents must be closed when cooking, and opened, in the case of meats, after boiling one hour, then closed hot, and returned to kettle, and boil three hours for fish and less for meat without bone. Fruit is vented, and closed when finished. S. H.

WE noticed in a recent issue that a London scientist was trying to produce cats without tails. The Philadelphia *Ledger* suggests that the experimenter will be a greater benefactor by producing the tails without the cat. The writer had evidently heard a discussion on his back yard fence, the night before.

### SPIRIT LEVEL.

Secured on the level bar over the spirit tube is a guard plate, on which is held a slide that extends partly or entirely over the spirit tube, which it approaches very closely. The width of the slide is equal to the length of the bubble, or the slide can be formed with a slot equal to the bubble. The slide can be so adjusted that the ends of the slot will coincide with the ends of the bubble when the level is perfectly horizontal, thus facilitating the taking of true levels. If two inclined surfaces are to be arranged precisely parallel, the level




TYLER'S SPIRIT LEVEL.

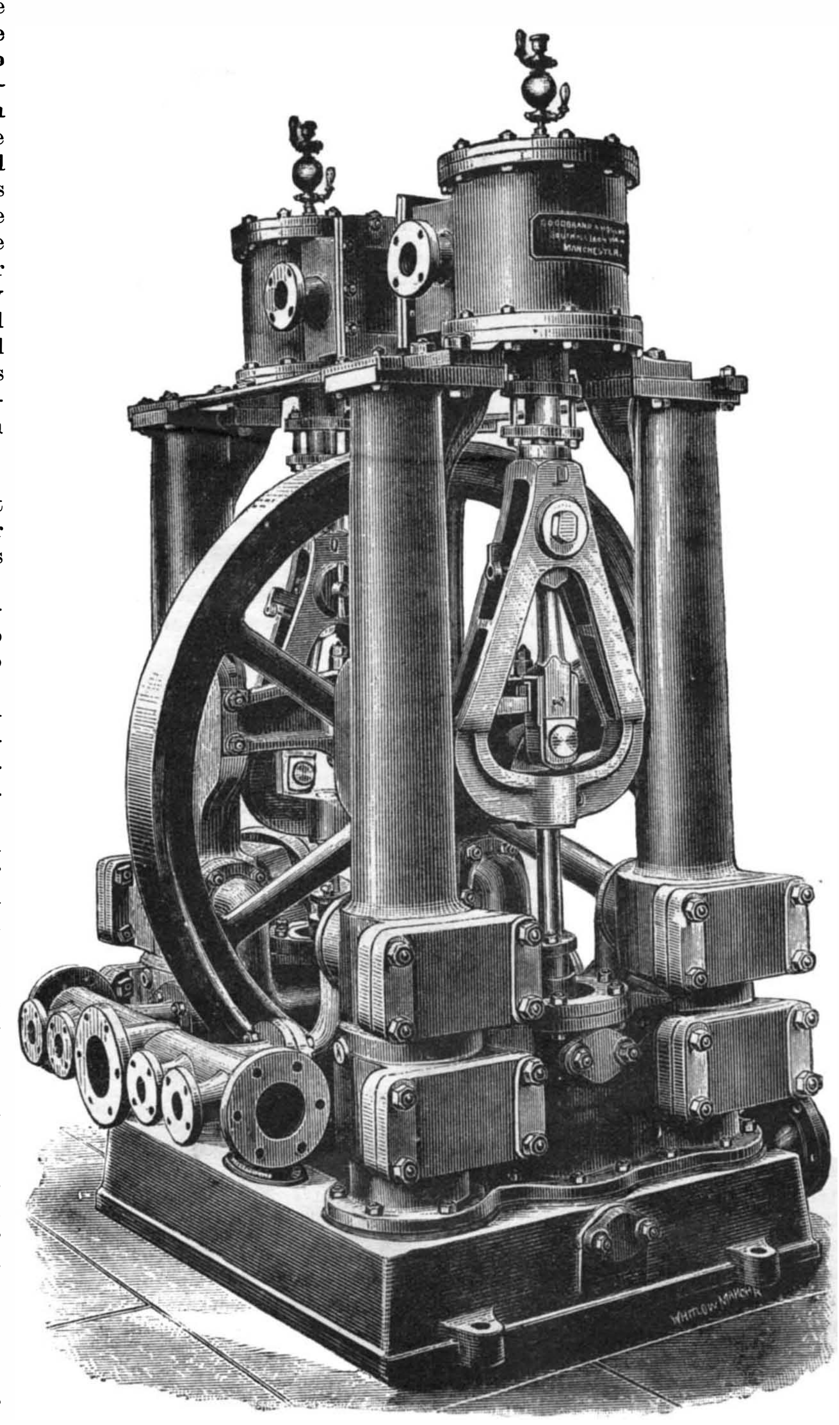
is placed on one of them, and the slide so adjusted that it will be over the bubble. The slide remains in this position, and the second surface can be adjusted until the bubble is below the slide. The uses to which surveyors and civil engineers can apply this instrument will be apparent.

This invention has been patented by Mr. B. F. Tyler, of Bridgeton, N. J.

### IMPROVED QUADRUPLE PUMP.

We have lately examined a very powerful pump made by Messrs. Goodbrand & Holland, of the Southall Street Works, Manchester, and give herewith a perspective view of it. This pump has several novel features which tend to increase its efficiency and durability, in both of which respects very satisfactory evidence was submitted to us. The pump is described as quadruple acting, that is to say, it has two double acting cylinders, as shown in the engraving. It is provided with two separate suction pipes, which may draw their water from one source or from two sources, as may be desired, the change being rapidly effected while the pump is at work. A very useful adjunct is found in the provision of air valves to each end of the water cylinders. The suction is led to a hollow base plate which forms the foundation for the pump. The internal arrangement of this suction chamber, as we may be allowed to call it, is somewhat peculiar. The inlets to the upper and lower sides of the pump are in the form of nozzles projecting some distance into the chamber. Between each pair of nozzles is a kind of inverted flattened dome, carrying the pump barrel above, and supported below by a web connecting it to the bottom plate of the base. The result of this arrangement is the formation of a chamber on the suction side, securing a steady flow of water, while the comparatively contracted ways prevent oscillation of water from one pump to the other. All the water passages have large areas, and especial care has been taken to avoid air traps. The valves are of the circular grid type, the ways being arranged at an angle in such a manner as to give a whirling motion to the water.

Two purposes are effected by this simple contrivance: first, a larger volume of water is delivered in a given time than when the usual straight ways are used; and second, the rubber valve cover is slightly advanced or turned at each beat, and therefore presents a fresh surface at every stroke, and wears more uniformly, and for a greater length of time. Another advantage resulting from the use of this modified form of valve is that the pump may be run at greater speed than when the ordinary brass valves are used; 250 feet per minute being the ordinary rate of working. The delivery pipe, as will be seen, has seven outlets, the central one being prepared as a main discharge. As usual in pumps of this description, the columns are utilized as air chambers. The steam cylinders are inverted, 14 inches in diameter, the stroke is 10 inches, and the two engines are connected to the crank shaft at a right angle, so that the pump may be instantly started from any position. The water cylinders are each 8 inches in diameter, and are capable of delivering 224 tons of water per hour. The working parts are all unusually easy of access, and an idea of the compactness of the pump may be gained when it is stated that the floor space occupied is only 6 feet by 5 feet 6 inches.—*Textile Manufacturer.*



IMPROVED QUADRUPLE PUMP.

### Chlorine as a Disinfectant.

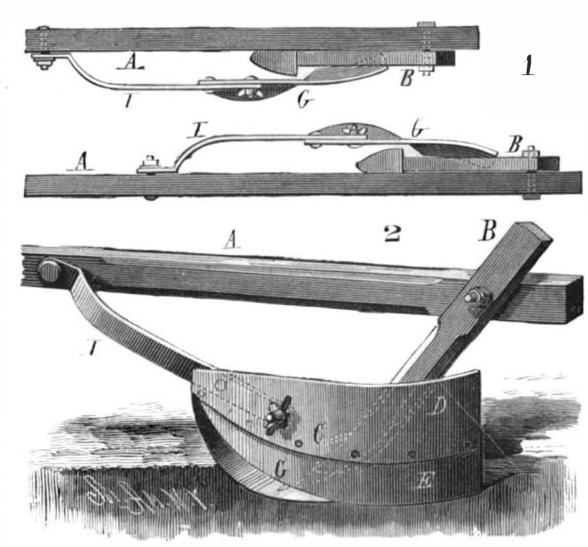
An investigation reported upon by Dr. Klein is the application of chlorine as an air disinfectant, especially in respect to swine disease. It has been shown that this disease is highly infectious, and that the infection is easily conveyed by the air, which is the usual manner of the communication of the disease. It was therefore considered by Dr. Klein to be specially suited for ascertaining experimentally the gaseous substance by which it could best combated. It is known that a healthy pig placed in the same stable with a diseased one is sure to take the disease, though the animals are carefully kept apart from each other. Dr. Klein therefore experimented as to the extent to which this atmospheric communicability obtained in an atmosphere impregnated with as much chlorine as the animals could endure without evincing discomfort. It was found that a healthy animal could with safety be placed in the same compartment with a diseased pig, even for so long a time as six hours, for five successive days, provided the air in the compartment was maintained well fumigated with chlorine gas, two good fumigations up to a marked pungency in the six hours being required. It was also found that one good fumigation with chlorine neutralized effectually the virus in a compartment from which a diseased pig had been removed, so that another animal could be placed in it without danger of infection.

### Four Engines in Collision.

Two heavy freight trains on the Nickel Plate road, each drawn by two engines, collided near Grand Crossing on Jan. 20, badly damaging the four engines; and killing an engineer named Charles Ellis. The loss is $20,000.

### COMBINED GUARD AND WEEDER.

The accompanying cuts (Fig. 1 is a plan view of the device as applied to the right and left hand beams of a cultivator, and Fig. 2 is a side elevation) show a combined guard and weeder, lately patented by Mr. Oscar Elce, of Parker, Dakota, the object of which is to protect small plants from clods thrown by the forward shovels, and to destroy weeds and grass that may be growing near. Attached to the beams, A, of an ordinary cultivator are the forward standards, B, and the forward shovels, C. The forward end of the plate, D,




ELCE'S COMBINED GUARD AND WEEDER.

which is about 8 inches high and of any suitable length, is straight, and has its lower edge rounded, as shown in Fig. 2. To its lower edge is riveted a narrow steel plate, E, the forward part of the lower edge of which is rounded, and its lower forward part is inclined inward toward the plants. The middle part, G, of the plate is vertical, and its rear part has an outwardly projecting horizontal flange, as shown in Fig. 1.

When the cultivator is drawn forward, the inclined part of the plate, E, runs close to the plants, from which the weeds are pushed back, while the flange cuts off the roots of the weeds. The curved rear parts of the plates push the weeds below the forward shovels, forming a low ridge, which the rear shovels (not shown in the drawings) level down. The weeder is drawn by the bar, I, the forward end of which is bolted to the beam, and the rear end to the plate, D. At the extreme lower end of the bar is a clamping bolt that passes through a slot in the plate, and by means of which the guard and weeder can be adjusted to work at any desired depth in the ground.

### Cleaning Clock and Watch Movements.

A bath can be prepared as follows, which will cleanse the movements of clocks and watches to perfection: One quart of water, about one teaspoonful or five grains of liquid ammonia or alkali; into this liquid should be grated or scraped fine, five grains of common soap.

These proportions can be varied as desired, if the following remarks are kept in view:

The articles to be cleaned should be plunged into this bath, where they should be allowed to remain at least ten minutes. Twenty or thirty minutes is better, especially for clocks. The articles should be wiped dry when removed from the bath, or polished up with a brush dipped in some polishing powder. The articles ought then to look like new; if this is not the case, they should be placed again in the bath, to which a small quantity of alkali must be added, as it may have lost some of its strength in the bath.

*Remark.*—The alkali has the great advantage of not attacking the pieces of steel; when pure, it leaves the temper in all its purity. If the quantity of alkali is increased, the copper will become black, but the steel will not suffer in the slightest. When pure, if used very quickly, the alkali will clean instantaneously gold and silver watch cases, a brush dipped in polishing powder being used to dry the article and brighten the polish.

This bath can be corked and set aside for future use, as it keeps very well. If it loses its strength all that is necessary is to add more alkali.

A PIANOFORTE railroad car is being built in Birmingham, England, for the London and Northwestern Railway. "Appliances will be provided by which the sound of the carriage wheels will be deadened, so as to preserve the harmony of the music."

### How Rubber Boots and Shoes are Made.*

Did you ever see any crude rubber, and have you any idea how it is gathered and worked? There are twenty or thirty varieties of crude rubber, varying greatly in quality, and of all these the best is known as Para, a South American product, obtained in Brazil, about 1,800 miles above the mouth of the Amazon. It is called Para from the city of that name from which it is shipped to foreign parts. The gum is gathered by tapping the rubber trees, as we tap maple trees for sap for maple sugar. The sap is gathered into a large pot into which the native dips a flat wooden paddle, to which gum adheres. He withdraws the paddle and holds it in a smoke made by burning palm nuts, which dries and cures the film of rubber on the paddle. He then dips again, and smokes again, repeating the process until he has on the paddle a bunch of gum weighing several pounds. Then he splits the ball or roll to get the paddle out, and it is ready for market.

These native are not models of honesty, however, as these chunks of gum frequently contain palm nuts, rubber nuts, pieces of iron, or are freely mixed with sand to add weight, which often causes the manufacturer great trouble. The public, or a large share of the public, have an idea that crude rubber gum comes something like tamarac, and that it is melted and cast into whatever form is desired, but this is not true. A rubber shoe factory is not a foundry; it comes nearer being a printing office.

These chunks of rubber are sliced into steaks, you might say, by sharp knives revolving rapidly and kept constantly wetted. When one of these knives strikes an iron spike, there is apt to be "music in the air." The operators are on the lookout, however, and accidents are so thoroughly guarded against that they are very rare. These steaks are then put into a chopping machine, where they are made into an article closely resembling boarding house hash, only that this hash is the straight goods, except that it needs cleaning. The small pieces thus formed are then put through a machine which makes mince meat of them, and at the same time washes out all the dirt and sand. This (not the dirt and sand) is now shoveled into a rolling machine which compresses the mass into rough sheets. This is the first process. These sheets are then taken to another building and put into a steam drying room, where they remain about three months to free them from all moisture.

By the drying process they lose from 15 to 30 per cent of their weight. If the least moisture remains in the rubber when made up into shoes, the heat of vulcanization causes its expansion, and consequently causes blisters in the stock. The dry gum is then run between heavy iron rolls, heated by steam, and called grinders, by which it is softened to permit the admixture of the vulcanizing material.

Rubber in its natural state is unfit for use, and Goodyear's process of vulcanization by the aid of sulphur is necessary to utilize it. This mixing is done by running the ground rubber through still another series of rollers, which press the rubber and sulphur together in one soft, fine body, which is finally run through a calender, between great steel cylinders; the mass is pressed out into long smooth sheets of any desired width or thickness. Then comes the printing process. These sheets are fed through steel cylinders on the face of which is engraved the pattern for sole, heel, and upper desired to be produced, and these impressions are as clearly printed on the rubber as this type impression is on this paper.

Then the sheets go to the cutters, who cut out the different parts and send them to their respective departments. The lasting is done similarly to that of other shoes, except that the parts are all put together by rubber cement, and, before removal from the last, they are placed in the vulcanizing ovens, where they are subjected to a degree of heat that transforms the various parts into a homogeneous mass in the shape of a boot or shoe with a seam, nail, or peg. Then, if a dull finish is desired, the last is removed, and the goods are ready for market. Otherwise they are varnished to give the bright finish, and dried, when they are ready.

### Electric Lights for Dwellings.

Several different systems of electric lighting are in vogue in French private houses, but, says *La Nature*, they are all somewhat costly. One of the best systems is that of Gaston Menier, in which 150 Swan lamps are used, supplied by a series of 22 accumulators. These nominally yield from 40 to 50 amperes, which are sufficient to supply 60 lamps at a time—a number more than sufficient for any ordinary purpose. The accumulators are charged each day by a continuous current Gramme machine, regulated by resistances introduced into the circuit. The machine is driven by a 5 horse power "Otto" gas engine. With a little practice, the servant who has charge of the lighting can, it is said, estimate the consumption pretty accurately, and recharge the accumulators; allowing an excess of 10 or 12 per cent for loss—possible errors. When it is necessary to use all the lamps, the direct supply from the machine is added to that of the accumulators.

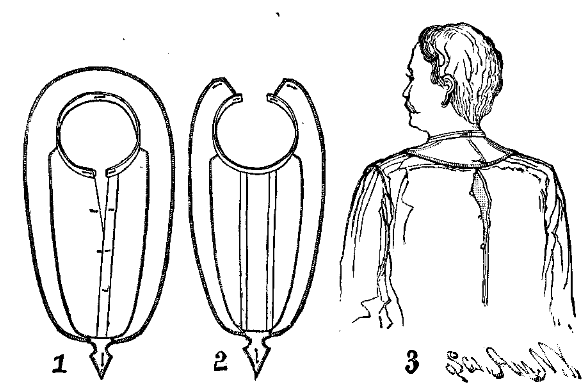
* "Cincinnatus," in Chicago *Shoe and Leather Review.*

### DETACHABLE SHIRT BOSOM.

The accompanying cuts represent an invention patented by Mr. George W. Lee, of Ridgewood, N. Y., which relates to that class of bosoms which are worn on woolen or other shirts, or over ordinary dress shirts in case the bosom fixed in the shirt is soiled. The bosom is made of muslin, or other material, and is secured on a backing provided at its top with two wings, forming a cape at its upper corners. A neck band is secured to the upper end of the bosom and along the inner edges of the wings or cape. In the lower corner of one wing is a buttonhole, and on the other wing is a button. In wearing the bosoms, the wings, of uniform or nearly uniform depth, where attached to the neck band and forming a pendent cape hugging the sides and back of the neck but not extending out to the shoulders, are adjusted to their place in such a way that their ends come together on the back directly below the neck.

The front collar button or stud is passed through the shirt, the buttonhole in the neck-band of the bosom, and through the holes in the ends of the independent collar to be attached. The rear collar button is passed through the hole in the band of the shirt, through the holes in the ends of the neck-band, and through the rear buttonhole in the collar. The button on one wing of the bosom is passed through the hole in the other wing, thus holding the ends of the wings at the lower corners, the upper corners being held together by the rear collar button. The lower attached cape formed by the wings, by hugging the sides and back of the neck only, gives an excellent fit, and the bosom is not liable to be shifted or the independent collar to be displaced.

When made as shown in Fig. 1, the wings are united



LEE'S DETACHABLE SHIRT BOSOM.

at the rear, and the collar band is opened at the front. In this case the bosom is held by means of the front collar button, which is passed through the shirt, through the holes in the neck-band of the bosom, and through the two holes of the collar, and by the rear button passing through the neck-band of the shirt, the neck-band of the bosom, and then through the outer collar.

### Draught of Boiler Furnaces.

The question frequently arises, What is the proper way to regulate the draught of a steam boiler furnace—by opening and closing the ashpit and furnace doors, or by means of a damper in the flue leading from boiler to chimney?

There is some difference of opinion and practice regarding this matter, which probably arises from differences or peculiarities in the constructive details of various boiler plants, which might make it desirable or even necessary to regulate one way in one case and the other way in another case.

Our own preference is decidedly in favor of regulating the draught by means of a damper placed in the uptake or pipe leading from the front end of the boiler, smoke box, or front connection to the main flue. This uptake should be made of wrought iron, and riveted securely to the boiler shell, and the damper should be fitted as close to its lower end or the tube openings as possible, and be provided with a convenient hand attachment whereby it may be set at any desired point and secured there.

There is much less liability of burning out the grates in a boiler furnace when the draught is regulated by a damper than there is when it is regulated by the ashpit door. For, let the ashpit door be closed tightly, and all circulation of air in the ashpit is stopped; there is nothing to prevent the heat from the layer of incandescent fuel being transmitted downward and overheating the grates, and overheating means warping, twisting, and cracking of the bars, and we have known them to be melted from this cause.

When, on the contrary, the ashpit doors are fully open, there is nothing to prevent the free circulation of air throughout the pit, and the bars are kept cool. We recommend omitting altogether doors to the ashpit, and making the opening through front nearly the full width of the grate, and making a water cavity or trough at least 6 inches deep in the bottom of the ashpit. This should be kept full of water, as it has a great effect upon the temperature below the grates.

For ease and certainty of regulation, a damper placed in the uptake, as described above, possesses great and obvious advantages over any manipulation of ashpit or furnace doors. Any one who has had charge of boilers fitted up in this manner can readily appreciate the truth of this statement.

There is, also, in our opinion, decidedly less loss of heat by infiltration of air through cracks in the setting walls when the draught is governed by a damper in flue than there is when the doors are used for same purpose; for, when ashpit doors are tightly closed, the draught of the chimney will draw air in through every crack and crevice in the walls, and this air entering the furnace at all points has a cooling tendency which it is most desirable to avoid. If the ashpit doors are opened, however, any leakage past the damper will readily be supplied by air passing through the fire, which is always the way air should go into a boiler furnace.

The damper should always be so fitted and adapted to the boiler that, when it is tightly closed as far as it can be by the apparatus provided for operating it, it will allow sufficient draught to just keep the fires going, and carry off any coal gas which may be generated in the furnace.

The foregoing relates more particularly to boilers used for power purposes, and those plants of such size as to require the constant supervision of an engineer or fireman. With many of the small house heating boilers where the draught is automatically regulated, it is deemed expedient by most steam fitters to regulate the draught by the ashpit door. For boilers of this type, this is undoubtedly a good plan in many cases; with the attention this class of boilers receives, there is probably less danger of filling up a house with coal gas.—*The Locomotive.*

### Ballooning a Hundred Years Ago.

The 7th of January marked the centennial of the first aerial voyage—on record—ever made across the English Channel; and it was made by an American, not an Englishman, Dr. John Jeffries, of Boston. He was a successful surgeon in London, and was scientifically interested in air voyaging. He paid a hundred guineas for a balloon trip from London, to Kent, in 1784, with the French aeronaut Blanchard. This was so successful that he agreed to pay some $3,500 or more for a voyage across the channel. There were no gasometers for illuminating gas in those days, so ballooning was not an easy matter for long distances—or even short ones.

Blanchard, like some other aeronauts since, tried hard to escape his contract; even *a vest lined with lead*, sent home by the tailor to the wrong address, and which it was supposed would make their ascent difficult if not impossible, fell into Jeffries' hands. Finally they got off from Dover at a quarter past one o'clock, "the *little* hero," as Jeffries called him, "the little heroic captain," being absolutely driven to start by his scientific employer. Jeffries had studied the wind, and was more decided than the pilots were, who said it would not extend (fair) beyond mid-channel. They "had risen considerably" by half past one, and could count thirty-seven towns and villages, with "a formidable view" of the breakers on Goodwin Sands. The same formidable view of the waves continued to enliven the proceedings. They seem to have seesawed most of the way, throwing "overbasket" in their rise and fall, first, their ballast, then books, and even the brandy bottle.

They finally landed about twelve miles from the sea, in the wood of Guines, and not so far from Calais but that they reached there (after frequent hospitalities by the way) at one o'clock that night. Dr. Jeffries was made quite a hero at the French Court, and was on the best of terms apparently with Dr. Franklin, at Passy, and Mr. Jon. Williams; with Com. Paul Jones, Mrs. Bingham, "a very genteel American, from Philadelphia, and Mr. Bingham." His journal, which is given in the *Magazine of American History* for January, is second only to Sterne's in its charming and naive account of the France of that period. He "thanks God" for his safe return by sea to Dover, the end of February. Considering that eighty-six years later M. Naya, in that same Paris, could not guarantee any more than Blanchard where his balloons should land, when sent out from the besieged city during the Franco-German war, and that to-day, in the Jeffries Centennial, balloon voyaging is no more manageable than it was then for precision or utility, there is room yet for invention, and capital too, to be expended in air voyaging inventions.

### New Turkish War Ship.

Preparations have been made for launching the ironclad frigate which has been nearly seven years on the stocks at Constantinople. Length amidships, 292 feet; extreme breadth, 55 feet; depth of hold, 39 feet; tonnage, 4,167; nominal horse power, 800; armor, 6 inches, 7 inches, and 9 inches, extending 5 feet below the waterline and 15 feet above it; armament, ten 8 inch Krupps, placed in a central battery arranged for both fore and aft as well as broadside firing. The ship is to carry, in addition, two 6 inch Krupps on the upper deck as ordinary pivot guns.

## Correspondence.

### Singular Boiler Explosion.

*To the Editor of the Scientific American:*

On Sunday, the 11th of January, one of the two boilers of the steam screw tug M. Dougherty exploded, completely wrecking the boat, killing two of her crew, and injuring three others. The boat was steaming up the Monongahela near Elizabeth, twenty miles above here. She carried two boilers, 14 feet by 30 inches each, with three 9 inch and two 8 inch lap-welded flues. They were allowed 175 pounds of steam. It is well established that there were two full gauges of water and but 160 pounds of steam at the time of the explosion. The shell was of first quality steel. The peculiarity of this explosion was that the larboard boiler exploded, throwing the starboard boiler upon the *left* bank of the river and high up on a neighboring hillside beyond, where the exploded boiler fell. The starboard boiler is sound.

T. C. N.

Pittsburg, January 16, 1885.

### Opportunities for Inventors in the Provision and Grocery Trade.

On every side we find that within the last few years improvements have been making rapid strides in every branch of trade we can think of excepting for grocers. The butcher and marketman uses to-day the same tools and nearly the same methods in vogue a hundred years ago. True, there is but little room to improve the knife, cleaver, or steel, but something is surely needed to lessen the labor and time of sawing, not only in the store or market, but also in the large packing houses. We have stood and looked at the band saw doing all manner of difficult scroll work, and wondered why some of the manufacturers have never tried to introduce them among the packers and marketmen.

The patterns already on the market would, we are sure, answer the purpose with one exception, that of the saw slipping on the driving drum or wheel, on account of the grease from the meat, but we should not think this much of an obstacle to overcome. The amount of lost time in doing the work by hand is enormous. The blades would have to be tempered harder than for woodwork; the general features of the machine could remain as at present. The circular or jig saw would not answer, for reasons that may be apparent to any one acquainted with the action of the bone under the saw while in the meat. The one item of sawing ham houghs is a big one alone, to say nothing of sawing beef bones to remove the marrow, shoulder, shank, and round bones. In the retail markets, sawing the bone in steaks is about the slowest and hardest work a man has to do. A sawing machine to run by hand, if a good one, would be a boon.

Again, can't some one get up a cheap motive power other than steam to run the grocery coffee mill? Even a spring motor that could be wound up quickly, so as to make from one hundred to one hundred and fifty revolutions of the mill, would be worth something if it could be wound up with a few turns of a crank handle, start, and left to run while the grocer was getting some other article for the customer. One who has never been in the business cannot know how valuable every minute is to a man with a store full of customers. You can't grind the coffee ahead, as no one will have it as a rule, even were it advisable.—*American Marketman.*

### Progress in Railway Improvements.

Railway inventions secure adoption very slowly. Looking back over the years, we remember that long after the Miller platform had proved itself invaluable, and was largely in use, one of our greatest trunk lines still coupled its cars with link and pin, and endeavored to render the transmit of passengers from car to car less dangerous and unpleasant by keeping a short plank across the ever varying gulf between the swaying cars.

The air brakes too were looked on by many of the older Eastern roads as a new fangled Western device of doubtful utility, and, till appalling accidents compelled, few of the New England railroads had condescend to adopt them; and to-day those selfsame roads find a hundred reasons why they should not adopt a uniform system of signals which has met the approval of a large majority of the railroads of the country.

Talk of insular prejudice! Why, ten years ago nearly all our railroad men scouted the idea of track signals other than a red flag or a ball hoisted on a pole. The complicated system used in England might do for John Bull, they said, but it would never be used here. To-day our principal railroads have not only adopted those very signals, but have even improved on the English block system. Now we have signals at short distances apart which indicate to the engineer with unerring certainty whether the track is clear to the next signal ahead, and which he is otherwise forbidden to pass. These signals are worked by the power of electricity, called into action by the passage of the train itself, and depending on no human agency.

Their automatic action is most interesting to watch. You may be standing near one, no train within sight or hearing. Presently you hear the distant rumble or see the puffs of steam that indicate the approach of a train. As it nears the signal you see the red disk fall, or the vane of lattice bars revolve, in time for the engineer to note its action. He sees it change, and knows at once not only that the track ahead is clear, but that till he has passed the next signal head, this faithful signal will forbid the passage of a following train. You wait and watch as the train disappears, and soon the red disk moves or the lattice bars revolve back to their former position, and you know that the train has safely passed the signal ahead. But this is not all. If the continuity of the track be broken by a rail removed for repairs, or if some straying cow has lain down on the track for a contemplative chew, the signal gives warning of the obstruction, and to fill the measure of its fidelity, if itself inoperative, it displays the warning signal of danger. Yet another purpose is served by electric signals. At level crossings and at stations a gong is made to ring when a train approaches within a certain distance, and the continuous ringing says clearly and unmistakably, "Train coming, clear the track."

But the most perfect of signals can only call attention to some fact, and so long as the element of human vigilance is required to note them, so long shall we remain liable to accidents arising from human infirmities.

The English system of connecting and interlocking switches and their signals, in such a manner that one man controls the action of many without moving from his box, and by which the setting of a switch for a certain movement of a train holds all others till that movement is completed, has already been adopted at some of our larger stations, and seems likely to be gradually adopted with the inevitable increase of traffic.—*Railway Review.*

### Hints for Those Who Intend to Build.

Any one who has built a house will be likely to recognize his own experience in the following article from the *Builder and Woodworker:* The ordinary man, the writer justly continues, has very little knowledge of the amount of labor required to get out complete working drawings for a good-sized building. Now, the intending builder contemplates building in the spring, say April or the beginning of May. What does he do? Instead of going to an architect during the winter months, when work is slack, and giving him his ideas, so that he may have time to work them out and develop them, he waits until a week or two before he is ready to build. Then the intending builder rushes off to an architect, and wants plans submitted to him at once. But every house must be treated by itself and separately, and the architect, like the physician, diagnoses the case, and takes measures accordingly. First he takes a survey of the ground; notices if there are any irregularities or peculiarities that may have to be overcome in a scientific manner. Then he prepares sketches, plans, and submits them to his client. Nine times out of ten some modification or alteration is desired—an alteration may be trivial in itself, but which may necessitate considerable careful thought and study.

With the sketch plans will be an appropriate estimate, which will generally come within a few hundred dollars of the actual estimate. Of course everybody wants a $15,000 house for $10,000, but this is such a trifle that every well educated architect is used to this pleasing trait, and would be disappointed if his client did not develop it. The alterations in the sketch plans having been made, the architect must get out a full set of working and detail drawings, showing with the greatest accuracy every important piece of construction and furnishing detail, very often full size of carving, or ornamental work or special features. These drawings have then to be traced, the tracings being used by the contractors, and the originals remaining in the architect's office, and becoming a part of the contract. All this takes time, but the builder is anxious to see his house under way, and wants matters rushed. When the drawings have all been prepared, contractors are invited to estimate on the work and furnish their bids, which of course is again a matter of time. But at last the lowest estimate has been accepted, the contract signed, and the ground broken for the foundations. The troubles and tribulations of the architect are by no means ended.

As the work progresses and begins to show its shape, the owner takes friends to see his new acquisition. Mr. A. suggests that the house will be a gem, but it ought to have a smoking room. Then Mr. B. visits the house and likes it ever so much, but there ought to be a little private room for its owner. Architect again consulted, and in some way or other a room is squeezed in. But these suggestions from the male side of the house are as nothing compared with the orders, hints, and suggestions furnished by the presiding member of the fairer sex. Ladies, as a rule, seem to think that houses will stretch like so much India rubber, and that it is as easy to add a room here, or a picturesque bower there, as it is to purchase the extra half yard for a dress, which every dressmaker finds her patron fails to provide. The moral of all this is that when you make up your mind to build a house, take plenty of time about it; having settled on your plans, allow your architect to carry them out, and don't attempt to change them half a dozen times, because if you do the result will be unsatisfactory.

### Prof. Benjamin Silliman.

Prof. Silliman, of Yale College, died at his residence in New Haven, Jan. 14, in the 69th year of his age. He had been ill since Oct. 6, and his death was caused by heart disease, which induced dropsy and uræmic poisoning.

During the last forty years the name of Prof. Silliman has acquired a steadily growing prominence in the several departments of chemistry, geology, and mineralogy. His father was the first to occupy the chair of Chemistry at Yale College, which he filled from 1802 to 1853, and was then succeeded by the son. *The American Journal of Science and Arts*, more generally known as *Silliman's Journal*, was founded by the elder Prof. Silliman in 1818, and the son at an early age became a contributor to the publication, which was afterward conducted by the son, together with Prof. Dana. In 1842 Prof. Silliman began to receive private pupils from Yale in analytical chemistry and mineralogy, and later to take advanced students in physics and chemistry, an enterprise which proved the germ from which has grown the present Sheffield Scientific School of that college.

In 1846 Prof. Silliman published his "First Principles of Chemistry" which became a standard textbook at once, and of which over 50,000 copies have been sold. In 1849 he was elected to the chair of Medical Chemistry and Toxicology in the Medical Department of the Louisville University, which at that time was one of the most flourishing institutions in the United States. He held this professorship for five years, until 1854, when he resigned to take charge of the instruction in chemistry in the Academical and Medical departments of Yale, a position which had been made vacant by the resignation of his father, the instruction in geology and mineralogy having been assigned to Prof. Dana. He resigned his position in the Academical Department in 1870, but continued to serve the college in the Medical Department. In 1853 he had charge of the chemical, mineralogical, and geological departments of the world's fair in the Crystal Palace in New York, and in connection with Charles R. Goodrich edited, the following year, "The World of Science, Art, and Industry" and "The Progress of Science and Mechanism," in which the chief results of the great exhibition were recorded. In 1858 he published his "First Principles of Natural Philosophy and Physics," a second edition of which was issued in 1861.

He was one of the 50 original members named in the act of Congress of 1863 incorporating the National Academy of Sciences, and served the Government during the war on some important commissions. He made three visits to California—in 1864, in 1867, and 1872—occupying his time with professional work in the mines, and mineralogical and geological explorations. In 1868 he presented his private cabinet of minerals to Cornell University, where it is labeled with his name. He made important additions to the mineralogical collections of Yale, and the metallurgical cabinet of the Yale Scientific School is the result of his explorations and labor.

Prof. Silliman had been the State Chemist of Connecticut since 1869, and in this capacity was frequently called to the witness stand as an expert in murder and other trials, and he was also employed as an expert in numerous patent cases calling for an exceptionally good acquaintance with chemistry and physics. He printed, in addition to his more ambitious works, a great number of memoirs on scientific and practical subjects and many addresses and opinions which are valuable as contributions to scientific history. He was one of the trustees of the Peabody Museum of Natural History, and was a member of numerous scientific societies on both sides of the Atlantic.

### The Mersey Railway.

The whole length of the tunnel under the river Mersey, which is 1,300 yards from quay to quay, is now arched in, and the greater part of the land approaches are finished, so that the laying of the permanent way will shortly commence. The total length of the line will be 4½ miles, independent of some extensions now being proposed. It runs from the London and Northwestern and the Great Western joint lines at Birkenhead to the Central Station at Liverpool, the course being chiefly under the public streets in the land portion. The underground parts of the stations at Greenlane, Tranmere, and Hamilton Square, Birkenhead, with that at James Street, Liverpool, are in a forward state. The hydraulic machinery for lifting train loads of passengers, the machinery for mechanical ventilation, and the locomotives and carriages are in course of manufacture. It is expected that the railway will cost half the mileage rate of the Metropolitan Railway, and that the main line of three miles will be opened about June next. The engineers are Messrs. J. Brunlees and C. Douglas Fox; the contractors are Major Isaac and Messrs. John Waddell and Sons.

### Gas Tar as a Health Preservative.

The serious outbreak of cholera with which France has recently been visited has caused inquiry to be made as to the extent to which persons engaged in particular manufacturing operations enjoy immunity from or are rendered more susceptible to the attacks of epidemic disease. It has been known almost ever since the establishment of gas works that the exhalations arising in the various processes of gas manufacture, although, perhaps, not specially pleasing to the olfactory organs, are not detrimental to health, but are, on the contrary, highly beneficial in special forms of disease, such as whooping cough and croup. The extensive use, in throat ailments, of preparations in which some form of carbolic acid figures largely is a testimony to the value of this derivative of coal tar as a therapeutic agent. A recent issue of the *Journal des Usines a Gaz* contained an article in which particulars are given respecting certain investigations made by a Dr. Lemaire some years ago into the subject of the influence of coal tar and its derivatives upon the health of the workmen employed in the preparation of these substances. His inquiries were made chiefly in connection with the employes of the Paris Gas Company. He found that those whose duties did not necessitate a prolonged stay in the parts of the works where tar was to be found were liable to all kinds of ailments, and formed a considerable proportion of the number on the sick list; while among the workmen specially occupied with tar, only three were sick in the course of seven years. This result is all the more striking when the number of workmen in the service of the company at the period referred to is considered. There were altogether 20,553 men, of whom 764 were engaged in some occupation connected with tar.

Dr. Lemaire also cites the case of the Bayonne Gas Works, where the workmen had not only not been attacked by cholera during its prevalence, but generally enjoyed immunity from skin diseases. M. Bouley, a professor at the Veterinary School at Alfort, found, as long ago as 1860, that gas works employes escaped during cholera epidemics; and the communication of this fact to Dr. Lemaire caused him to institute his inquiries into the subject.

### Whole Meal Bread.

The late exhibition of breadstuffs at Humphrey's Hall, Knightsbridge, although it was not so largely attended as was expected, has been the means of reviving attention to the subject of whole meal, so strongly advocated by the Bread Reform League and by its indefatigable honorary secretary, Miss Yates. If the chemists alone had to decide the question of the relative values of whole meal and ordinary white bread, the public would have to wait a long time before it could obtain a satisfactory reply; for on this point chemists differ more than doctors. If we interpret the opinion of the profession of medicine correctly, there is a growing disposition in favor of the whole meal bread, on practical rather than on theoretical and chemical grounds. The bread which contains all the constituents of the wheat, except the outer, insoluble, and irritating portion of the seed, seems, when the appetite for it has been obtained, to be more satisfying and digestible than the white and fashionable product which is found on most tables, of rich and poor alike.

It is believed, too, that for children the whole meal is the best for sustaining growth and for building up the skeleton strongly and in perfect form. The supply of whole meal bread is now much facilitated by the improvements that have been introduced in the decorticated or granulated flour, to which Lady John Manners has called public attention in her late paper on Wheat Meal Bread. In the decorticated whole meal the extreme outer coating of the wheat grain is, by a special process of abrading, to the perfection of which Dr. Morfit has rendered able service, cleverly removed. After the abrading process is completed the whole of the grain is reduced to a fine flour, in which there is retained all the substances that are nutritious and digestible. Considering the fact that the whole meal bread, when it is properly manufactured, is easily assimilated, we are lead to the conclusion that it must be more nutritious generally than other bread, in which starch predominates. But we do not wish to be dogmatic, and would prefer, before pronouncing a strong opinion, to hear what medical men from their unlimited field of observation have to say. It is for this reason we direct attention to a topic which must soon be very widely discussed among all sections of the community.—*Lancet.*

### A SIMPLE MODE OF ASCERTAINING THE REVOLUTIONS OF A SHAFT.

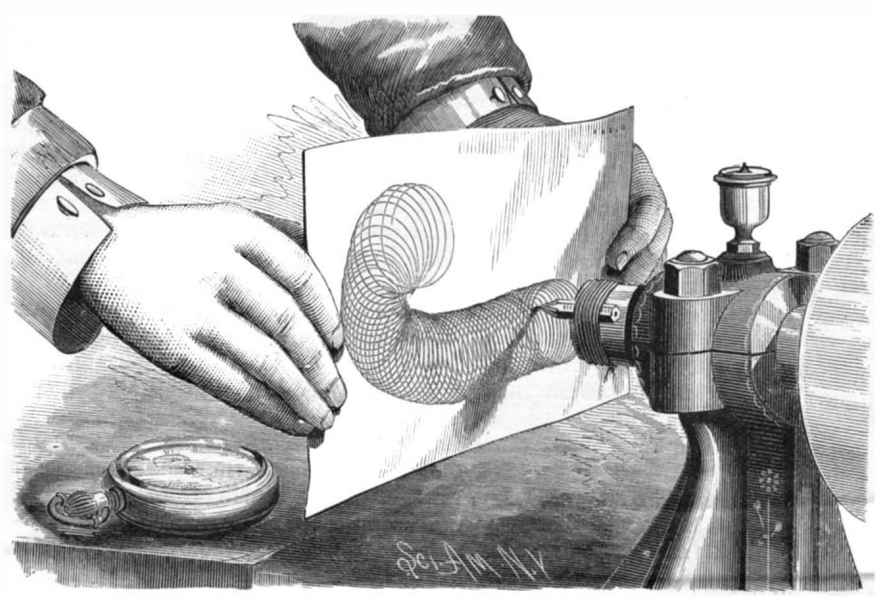
*To the Editor of the Scientific American:*

Noticing a revolution counter in one of your recent numbers, I send you an automatic record of 582 revolutions per minute made by a process less generally known than it should be.

A lead pencil is tied to the end of a shaft so as to revolve in a circle of convenient size. A piece of paper is lightly held against the end of the pencil, which, if the paper is held still, traces a circle upon it; but if the paper is moved backward and forward, the pencil traces a series of loops intersecting each other. It is easy to count them, and thus to determine the number of revolutions made while the paper touches the pencil.

I inclose a record, which, having been in position ten seconds, shows that the velocity was 582 revolutions per minute. M. C. MEIGS.

Washington, D. C., December 20, 1884.



SIMPLE MODE OF ASCERTAINING THE REVOLUTIONS OF A SHAFT.

[The accompanying engraving clearly shows how the pencil is fastened to the shaft and the position in which the paper is held.]

A VERY good artificial stone is made by using one part of Portland cement and three parts clean, sharp sand.

### Milldams.

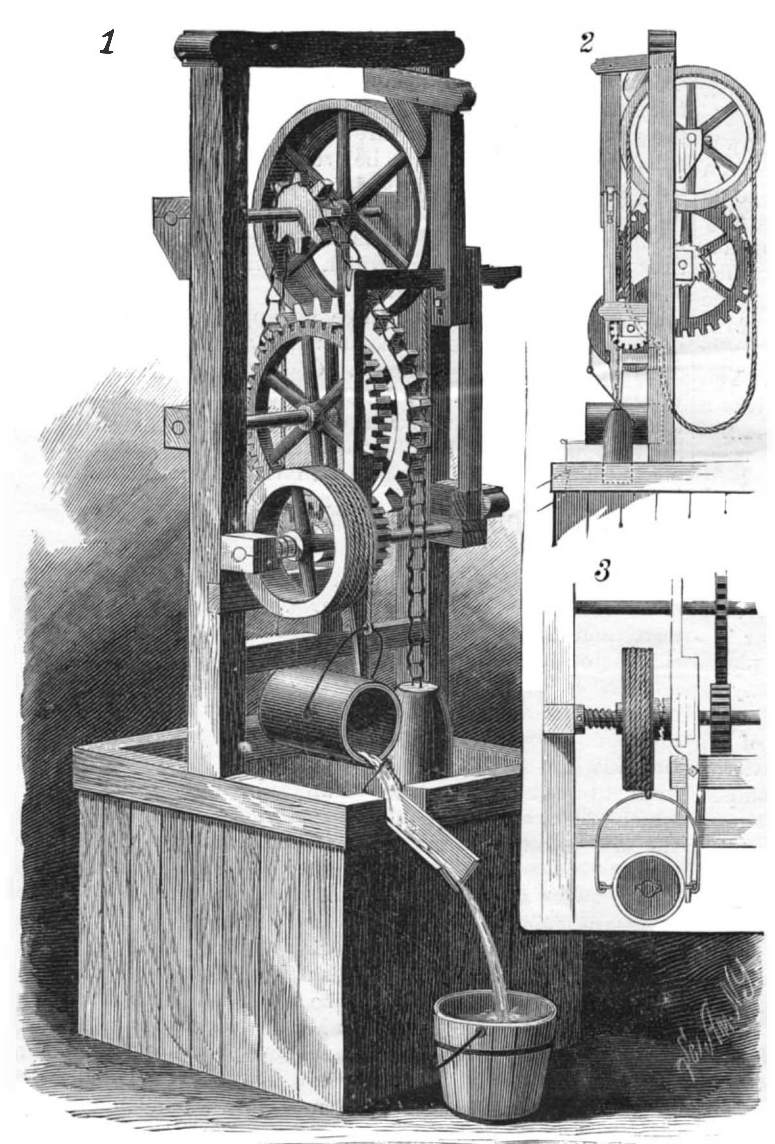
A decision by the United States Supreme Court, in a case which was carried from New Hampshire, has just been rendered, which will interest all men who have anything to do with water power in general, or with milldams in particular. Many of the States have laws which authorize persons to maintain milldams on streams which are not navigable, the dam being erected upon property owned by the persons, upon condition that they shall pay to the owners of the land which may be overflowed such damages as may be assessed. In the case in question, the claim was made that the effect of such a law was to deprive the owners of overflowed land of their property and the uses of it without due process of law, and hence that the statute was in violation of the Fourteenth Amendment to the Federal Constitution. In the opinion rendered January 5, by Justice Gray, of the United States Supreme Court, he sustained the validity of the New Hampshire act, and this may properly be regarded as a test case, and very probably it will result in upholding the milldam laws in other States.

M. JABLOCHKOFF announces another battery of great scientific interest. A small rod of sodium weighing about 8 grammes is squeezed into contact with an amalgamated copper wire, and flattened. It is wrapped in tissue paper and then damped with three wooden pegs against a plate of very porous carbon. This completes the element. The moisture of the air settles on the oxidized surface of the sodium. It works without any other liquid. The E. M. F. is 2·5 volts, but the resistance is as great as 25 ohms.

### WEIGHT POWER MACHINE.

The engraving represents a machine for utilizing weights as a power for lifting water or for other purposes. Journaled in brackets on the uprights of the frame is a shaft carrying a wheel, on one side of which is formed a grooved pulley over which passes an endless rope, and a sprocket wheel over which extends a chain having a heavy weight at one end. The chain also passes over part of a sprocket wheel loosely mounted on its shaft, and provided with a pawl engaging with a ratchet wheel rigidly mounted on the shaft. On this shaft is a cog wheel that engages with a pinion on the lowest shaft, on which is loosely mounted a drum having a spiral groove in which winds a rope to whose free end is suspended a bucket. The drum has a clutch hub to engage with a clutch sleeve that turns with, and slides on, the shaft. A lever, connected with the sleeve, is pivoted to a cross beam, and has its upper end pivoted to a bar sliding transversely; the lower end of the lever is so placed that the bucket will act on it. (This construction is shown plainly in Figs. 2 and 3.) In the bottom of the bucket is a valve, opening upward, and on its top edge is a hook arranged so as to catch on a wire bail at the end of the spout. A brake shoe is so placed as to bear against the face of the wheel on the upper shaft; the arrangement of the levers for operating this brake is shown in Figs. 1 and 2.

The weight is raised by turning the upper shaft by means of the endless rope. The bucket being at the bottom of the well, the clutch collars are disengaged and the brake lowered to rest upon the pulley, thus preventing the pulley from revolving, and stopping the entire machine. When the machine is to be operated, the lower lever is moved so that the clutch collars will engage, and as the same movement releases the brake the weight descends, the drum revolves, and the bucket is raised. When it arrives at the top, the hook catches on the bail and the bucket is swung to horizontal position, permitting the water to flow into the spout. As the bucket swings up, its bail acts on the lower end of the lever, and moves it in a direction contrary to that in which it was moved to start the machine; the brake then prevents the further descent of the weight. The bucket descends immediately after it has been emptied, a spring, coiled by the unwinding of the rope, regulating the speed. The weight can be so adjusted that by raising it once several buckets of water can be raised before it becomes necessary to again wind up the weight.




VANDERCOOK, SMITH & BAKER'S WEIGHT POWER MACHINE.

This invention has been patented by Messrs. M. Vandercook, W. P. Smith, and H. M. Baker, and particulars can be had by addressing Mr. W. P. Smith, of Manton, Mich.

### THE MASON WASP.

There is no one living in a warm country who has not observed certain little earthen structures of irregular form sticking to the beams, wainscoting, and walls of houses. At first sight, we would readily take these little masses for lumps of mud or for heaps of dust piled up by chance and left through the negligence of servants. This is not the case, however, and if we take the pains to examine these bits of earth with some attention, we shall find that they are nests whose architects belong to the family of mason wasps—hymenoptera of the tribe Eumenidæ.

The round apertures formed in the external face of these nests are so many orifices through which the perfect insects have made their exit. These latter, after each of them has undergone its mysterious metamorphoses in a separate cell, finally cast off their chrysalid envelop, and, after a long seclusion, come forth to enjoy life and light.

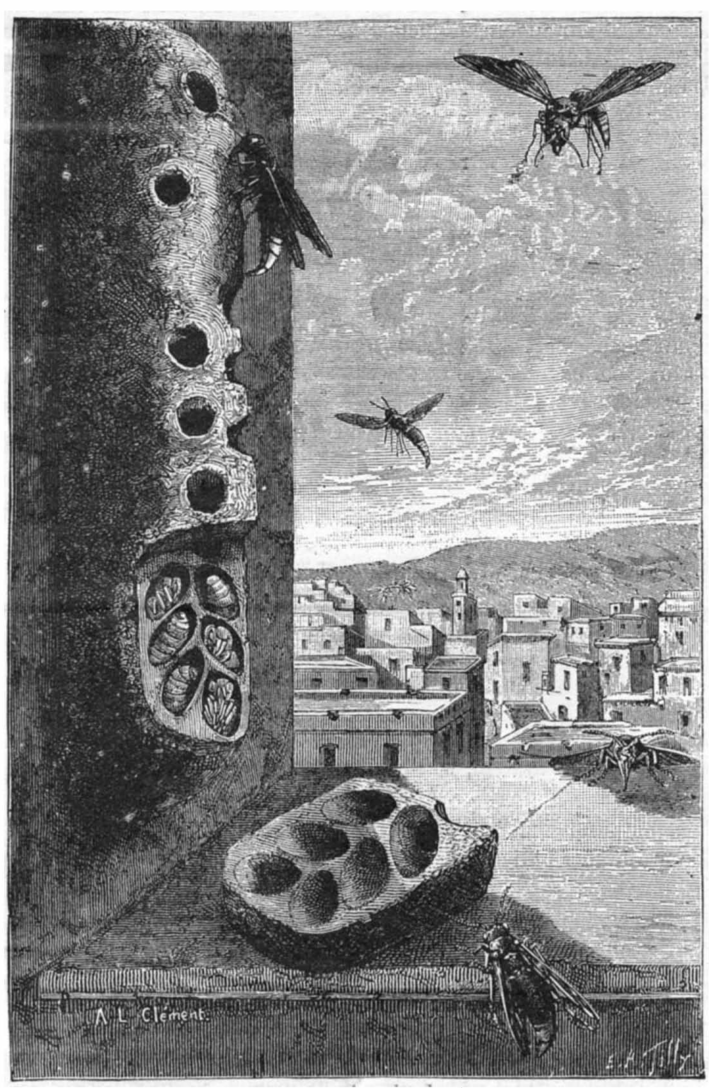
Let us watch the work of a solitary wasp. The insect resembles a large black fly, and its violet and iridescent wings have a most brilliant luster. Its abdomen, which is separated from its thorax by a very pronounced constriction, renders that comparison very just that our fathers instituted between these elegant insects and our grandmothers pinched up in their long corsets. The last rings of the abdomen are red, and the same is the case with the front, which is varied with fawn color. The mandibles of the male are curved in the form of a sickle. They remind one of the saber of an Abyssinian warrior, and, through their large size, out of all proportion to that of the insect, produce a most curious aspect.

This wasp is a stinging hymenopter of the division diploptera, and is known to science as *Synagris calida*, Fab. The female does the constructing of the nest. She begins by selecting a place along a beam or in the angle of a window, and, after a careful examination of the surroundings, flies away. Soon she is seen returning loaded with a lump of mortar made of sand that has been moistened with her saliva and kneaded with her mandibles. By means of these latter organs she applies the lump to the wall, spreads it out and shapes it, then makes another journey, and thus succeeds in accumulating a certain quantity of mortar. In a few days there is seen a rounded structure of earth, as long as one's finger, or flat and elongated, as shown in the engraving. The nest is then perforated with round holes, each of which corresponds to a very regular oval cell whose sides are carefully smoothed. The number of these cells is often considerable—certain nests sometimes containing more than twenty. The nest is then thirty times larger than the architect. The mother lays one egg in each of the cells, and accumulates prey around it which, although alive, is incapable of defending itself against the young larva that will emerge from the egg and devour it. This future food is captured and prepared as follows: The wasp, having started on a hunt, hovers about shrubs until she spies a caterpillar. This she swoops down upon like a bird of prey, seizes its neck in her mandibles, and pierces it with her sting. The caterpillar makes a few convulsive movements, vomits up a green liquor, and falls back inanimate, when its enemy seizes it in its mandibles and carries it to her nest, and disappears with it in one of the cells. This operation is repeated twenty or thirty times, according to the number of eggs to be provided for, the mean number being six caterpillars for each. When this work is terminated, the wasp closes each aperture in the nest with mortar, and soon afterward dies near the structure that she has so laboriously built.

We shall now soon see emerging from the egg a small, feeble, blind, white worm, which will at once resolutely attack one of the caterpillars accumulated around it. The caterpillar, which is of gigantic size as compared with its enemy, will endeavor in vain to defend itself; its jaws will move convulsively and its rings will contract, but it will be unable to escape, and the gnawing worm will keep on penetrating deeper into its body, tearing its sides and lacerating its entrails.

This phenomenon is due to the fact that the caterpillar has been paralyzed, and, although alive, exhibits every appearance of death. The reason of this state of things is known. The wasp stings the caterpillar in the middle of the body in such a way as to reach one of the ganglions of the chain of nerves. This stinging brings on a paralysis due to the action of the poison. It is always at this place that the larva attacks the first caterpillar, and, moreover, the mother wasp takes care to lay the egg nearly on that part of the latter's body which is to be devoured first. After the larva has increased in size, and its jaws have become stronger, it attacks the other caterpillars at random, and often leaves one-half eaten in order to begin on another.

At the end of about a month the larva has reached its full development, stops feeding, and prepares to enter the chrysalis state. At this time it is a sort of rounded worm about two-thirds of an inch in length, of a creamy white or rose color, fleshy, nearly torpid, and completely destitute of legs. The anterior part of its body is inclined forward, and its little round head resembles a ball of opal from which the mandibles and jaws stand out in relief through their reddish tint. The larva consists of fourteen segments inclusive of the head. These rings are clearly defined, and are provided on each side with a rounded projection containing an aperture. These are the stigmata, or organs of respiration. There are ten pairs of them. When the larva has reached this state of maturity, it lines its cell with a preliminary network of silk, and then spins and envelops itself in a yellowish white, silky cocoon, taking care in doing so to leave its dejections in one corner of the cell, and to spin in such a way as to leave them outside of the cocoon. If the latter be opened after a few days, a wasp will be found therein, but it will be soft and wholly white, and its legs and antennæ, folded along the body, will seem, through their transparency, to be so many rods of crystal. The wings, folded in all directions and partially covering the legs, will seem like stumps. At this stage the mouthpieces are spread out on the prothorax, and the whole insect is bent double. But gradually the eyes become fawn colored, then brown, and finally black. The mouthpieces take on a color, the different parts of the thorax harden and assume their different tints, and finally the insect appears with all its colors. The *Synagris* still remains for some time in this nymphal state, but finally the hour of awakening arrives. It then frees itself from and devours the fine pellicle that invests it, tears the cocoon, pierces the wall of its cell, and at length sees the light. At first it is dazzled, but gradually it begins to stretch its wings in the sun and make them vibrate. It stretches out its legs and passes them over its mouth, and finally flies off in space, where it has a few days to live.—*La Nature.*



THE MASON WASP AND ITS NEST.

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#### Sulphur Fires in Cholera Epidemics.

In the autumn of 1872, when sanitary officer at the Sonepore Fair, and during the height of the pilgrimage, when the people thronged in thousands to the bathing ghats, Deputy Surgeon-General Tuson first used sulphur fires as a prophylactic measure against cholera. These fires were made at fifty yards apart, and kept alight during the whole time that the fair was at its height. Not a single case of cholera occurred; a remarkable circumstance, since cholera had generally broken out at previous fairs. A similar good result was obtained at Dinapore, where cholera was actually prevailing. In the pamphlet on this subject which is published by W. H. Allen & Co., Waterloo Place, Dr. Tuson has adduced certain facts and arguments in support of the contention that sulphur fires are efficacious in epidemics of cholera. The basis of his explanation of their efficacy is the germ theory of the disease.—*Lancet.*

#### Uses of Gelatine.

Gelatine being now in ordinary use in the photographic laboratory, it may not be out of place to point out some of the purposes to which it may be applied, otherwise than in the manufacture of sensitive dry plates.

Mr. Woodbury has already published that a thin five per cent solution of gelatine colored a strong yellow by a sufficiency of bichromate of potash makes a good cement for uniting pieces of broken glass. The glass must be warmed, wiped dry, the cement then applied, and the mended glass article then exposed to light for several days. He has also published that a strong solution of gelatine to which a little glycerine and red coloring matter, such as carmine, have been added makes a substitute for wax for covering the corks and upper part of the necks of bottles.

In the form of capsules, gelatine is used by druggists to hold many liquids of a greasy nature—such, for instance, as castor oil—so that they may be swallowed without the unpleasantness arising from their nauseous taste. The capsules are made by the aid of a small egg-shaped, highly polished little knob of iron, having a pointed iron stem by which it is held. The knob is rubbed with a slightly oily cloth, then dipped in the warm gelatinous mixture, after which the pointed stem is put into a hole in a board, while the gelatine on the knob is cooling and hardening. The gelatinous mixture usually consists of six parts of gelatine, twelve parts water, and one sugar. In a short time after dipping, the capsule is cold enough to be removed from the mould, which is done by cutting the gelatine round the upper part of the stem with a knife, then pulling off the capsule dexterously with the fingers.

At this stage it should be elastic enough to pull off without tearing, and to shrink nearly to its moulded shape directly afterward. A syringe with a nozzle bent at right angles to the axis of its cylinder is used to fill it to about three-fourths its capacity; if more were forced in, the gelatinous envelope might possibly break afterward with changes of temperature. The hole is closed with a touch of a strong solution of gelatine, and the same end of the capsule is then dipped in a weak solution of gelatine to give greater security by the thin cap thus applied. The gelatinous solution used for sealing the capsules always contains a small proportion of gum. The capsules having been allowed to dry, a polished appearance is given to them by rubbing them with a slightly oiled cloth.

Gelatine is one of the many substances sometimes used for the coating of pills, in order that they may not stick together in the box, and may not be tasted in the act of swallowing them. The solution used for covering them consists of one part of gelatine to two parts of water. The pills are cleared from any dust or powder which may be on their surface; then each pill is stuck upon the end of a piece of wire four or five inches long, and the lower end of the wire is thrust into a basin of sand, which acts as a kind of a pincushion. The pills are next dipped one at a time into the warm solution of gelatine; then the other ends of the wires carrying them are replaced in the sand, where they look like an assemblage of large pins standing while their gelatine-coated knobs are setting and drying in the air. Sometimes on removing the pills from the wires a little tube of gelatine from the outside of the wire comes off with it; this tube is carefully cut off with scissors. The hole in the gelatine where the wire pierced the pill is then closed with a little warm solution of gelatine, applied by means of a small brush of camel's hair.

One fact about gelatine does not seem to have received that attention in photography which it deserves, namely, its curious power of dissolving phosphate of lime—the chief constituent of bones. Furthermore, it always contains a little phosphate of lime, which may or may not by double decomposition introduce a trace of phosphate of silver into all gelatine argento-bromide emulsions. The late Dr. William Gregory, Professor of Chemistry at Edinburgh University, says: "The property of gelatinizing depends on the presence of phosphates; for when gelatine is long boiled with water alone, or with a little alkali, phosphate of lime is deposited, and the solution no longer forms a jelly on cooling." If this be so, the functions of phosphate of lime in gelatine and in photographic emulsions deserve more attention than they have hitherto received.—*W. H. Harrison, Br. Jour. Photo.*

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TRANSPARENT show bills may be cemented to glass windows in the following manner: Very fine white glue or preferably clean parchment chippings boiled in distilled water in glass or enamel until dissolved, must be applied very evenly with a soft hair brush to the face of the bill. Then press it on the glass, and in a few minutes the bill will be firmly fixed. Glass may be fixed to glass in this way, and the cement will bear a good deal of dry heat.

### The World's Fair at New Orleans.

It is often the fate of those who conduct great public enterprises to be accused of incompetence and censured for neglect when, had they succeeded, success would have been without applause and diligence without reward. Hence it is that the managers of the World's Fair, if we may judge from the reports in the popular press, are now under the ban of public disapproval.

Special reports leave the city daily for all parts of the country, testifying to the incompleteness of the buildings, the tardiness of the arrangements, and the inability of the managers to handle the mass of exhibits which daily arrives. These reports are sincere, and are written by disinterested persons, though for the most part after only a cursory examination into the facts. That they are unreasonable few will deny who are aware of the obstacles which have unexpectedly appeared to thwart the efforts of the managers.

Considering that the majority of the exhibitors were very late in their demands for space, it is not surprising that the construction of buildings to receive their goods was retarded; and when it is remembered that most of the exhibits, instead of gradually arriving, came at the same time, it is by no means remarkable that the managers were unable to handle them at once. We are not surprised when a dog essays to stand on his hind legs that he does it badly, but that he does it at all. When the railroad facilities were, of a sudden, well nigh swamped by thousands of tons of freight, considerate people could not fail to admire the business-like means the managers improvised to bring it, though tardily, to the grounds.

The exhibitors, their agents, or consignees, who were waiting to receive it, expected that it would be sent out from the city at once, and were, naturally enough, impatient at the necessary delay. Yet what railroad or other corporation of carriers would go to the expense of quadrupling their facilities to meet a few days' "rush"?

Looking at the conditions under which the managers worked, and what they accomplished notwithstanding the obstacles in their way, it would seem that they have used more than due diligence. In a little over thirty days' time the managers handled nearly five thousand car loads of exhibits, the major part arriving at New Orleans within a period of fifteen days. During nearly all this time it rained. To say that the roads were "heavy" will but inadequately describe their condition to those who have had no experience with Southern roads when they are well soaked. To make matters worse, much of this freight was heavy machinery. Notwithstanding this, all of these five thousand car loads were brought to the grounds, classified, and placed.

Under the direction of the managers, the various departments are assuming, day by day, an expression of completeness. New objects are assigned without delay to their respective departments, and to judge from the number and character of the articles already placed, and the rate at which they are arriving, it is not unreasonable to predict that the Exposition will prove a World's Fair as well in fact as in name.

The plans for an electric railway around the buildings and grounds are now well nigh completed, and the parts are being assembled. This railway is likely to prove more of a convenience than a novelty, for there will be nothing new in its construction, the charged rail system being employed. The electric lighting and power companies are rapidly getting their apparatus into working order. Some of the lights are now aglow, and that all were not long since in operation is surprising, since the several plants were in use in the Philadelphia Electrical Exposition. The fact is, the projectors and promoters of these several systems were not altogether satisfied with the pecuniary results of their efforts at Philadelphia, and some of them were averse to any further expense in the way of gratuitous exhibition, each being tempted only by the proclaimed intention of some rival to appear at New Orleans. There is reason to believe, however, that they will be amply repaid for the efforts they are now making, because the present exhibition partakes far more than did that at Philadelphia of an international character, and the opportunity of displaying the various systems side by side before the official representatives, especially of Mexico and the South American republics, is too good to be lost.

The railroad now about to be built from the city proper to the fair grounds—about five miles—is so obviously necessitated that it seems strange it was not long since projected and in running order. But even this neglect, all things considered, may scarcely be laid at the doors of the managers. A railroad is a costly construction, and with a treasury only adequate to supply the absolutely necessary expenditures for building and grounds, they could scarcely be taken to task for not anticipating in the early days of preparation the grand dimensions which subsequent demands for space have made the enterprise assume.

With the expenses which the managers have been compelled to assume, and notwithstanding the bad weather and the incompleteness of the exhibits, both of which would naturally tend to keep visitors away, it is satisfactory to know that the managers have not run into debts which the actual contracts with exhibitors will not serve to liquidate. This alone will do much to show the financial ability of the managers. We have the authority of Director-General Burke for saying that the receipts, or rather the credits, were equal to the current expenses even during the bad weather, and that now the good weather is arrived the revenues are nearly ten times as large, or, in other words, ten times the amount of the estimated expenses.

The cotton exhibit at the fair is, of course, likely to be one of the most important features if not the chief attraction to foreign visitors; and though it is as yet by no means complete, good circumstantial evidence is at hand to indicate that it will constitute a thorough *expose* of every process in cotton industry, from the picking to the manufacture. Indeed, this fair commemorates the centennial of the first shipment of cotton from the United States. Since then we have grown to be the chief cotton producer of the world, though not the largest manufacturer. Those who have got accustomed to lament the rapid advance of India as a cotton producer, and who fear she will finally usurp the market we have come to look upon as our own, would do well to come here and examine the labor saving machinery now being exposed in the cotton section. The more recent arrivals are the cotton picking machine and the Oldham invention for spinning cotton. These mechanisms are designed to greatly facilitate the work of the picker and the spinner, and should they be perfected—for as yet there is still something lacking—their designers will have succeeded in accomplishing what heretofore has been regarded as practicable only by those supposed to be suffering from mechanic lunacy. It is not too much to say that in this cotton picking machine especially the wildest dreams of the cotton planter are realized. For, as is well known, he can at present plant four times as much cotton as he can pick; and it not infrequently happens, so I am told, that he must leave what would have been hundreds of bales of cotton in the field to rot, because of his inability to pick it. And yet, if the accounts we have read of the first introduction of Whitney's cotton gin years ago are not gross exaggerations, the cotton picking machine exhibited here is not more remarkable nor more cunningly devised.

It is because of the well known ingenuity of the American mechanic and inventor, of which these machines are the expression and exponent, that has led many experienced persons to believe that we shall be able in the future to overcome the terrors of that bugaboo, "pauper labor," and that the cotton crop of the future will be capable of an infinite expansion.

Of the new spinning machine an authority says: "The new process of ring spinning, which has superseded the old mule system, will itself give way to this, which proceeds somewhat on the principle of the discarded twister; its main feature, by which it promises to achieve a great diminution in the cost of production, being that two turns of twists are obtained for every revolution of the spindle. It corrects all the defects of ring spinning, including the inequalities of the yarn, and renders 'snares' and 'corkscrews' which are of such frequent occurrence where mules are employed, impossible."

The department of machinery is now very extensive, and if the spaces already bespoken are also filled, there is likely to be a very sea of moving shafts and whirring belts. At present some of the best engines in the world are in motion, as well as some of the least reliable. What is promised for some of these engines by their owners is really astonishing, considering how well informed the general public has become in this regard. Why these absurd claims are made it is difficult to understand; for when it is remembered that an official record is being made of just what they are capable of doing, they are not likely to deceive even the tyro.

Three well known and rival thread manufacturers have each their machinery in place and in operation. It is hard to understand why there should be such rivalry between them as there would seem to be, for the production of each is excellent in its way, and their respective machinery seems the one to be contrived as ingeniously as the other.

A machine for making barbed wire fence, instead of being placed with the machinery, would have been more properly set agoing in that department of the Music Hall where the new means of teaching articulate speech is to be illustrated, for there would be there no sensitive ears to be jarred by its clatter and clang.

The objections that have been urged against New Orleans as a locality for a world's fair, though well taken when considered from a manufacturing standpoint, are by no means so obvious when other and indeed the chief aims of the project are looked at. New Orleans, besides being the great cotton seaport, is, all things considered, the most convenient point at which to collect exhibits from Mexico and Central and South America; and it is perhaps not too much to say that this fair is looked to to foster and encourage trade between these several countries and the United States by exhibiting side by side the products of each. Now, among the many unique features of this fair are the agricultural and horticultural displays, and for these the climate is peculiarly suited. Favored by the balmy air, gardens have been laid out in the grounds, wherein the diverse growths of Mexico, Central and South America, California, and Florida are displayed. Here are to be seen the orange, lemon, and citron, the mesquite, maguey, banana, and other fruits; and, now that the deluge has ceased, hundreds of beautiful flowers, each in its respective section, are being set out. Within the adjacent buildings there are fine collections of grasses, fungi, edible and poisonous, and, what cannot help but be of great interest to very many people, the gathering at one point from the remotest ends of this continent of well preserved collections of insects. These are divided into several classes: 1. Insects without a metamorphosis, changing their skin but not their form, as spiders, lice, wood lice, and myriapods. 2. Insects with a metamorphosis: *a*, those moving in all stages of existence, at first wingless, then with rudimentary and finally with entire wings, including the neuroptera, orthoptera, and hemiptera; *b*, motionless in the pupa state, but having limbs, including the hymenoptera, coleoptera, and lepidoptera; *c*, ovate pupæ, wingless and motionless, as the diptera. The agriculturist will be especially interested in these, because, in the case of those which are destructive to plant life, the various means of preventing their ravages are made to accompany the collection.

In the South Carolina exhibit, large and varied specimens are shown of the now famous phosphate rock, so called. These are grouped together into a huge pyramid, making it easy for the interested and curious to examine the various nodules, all of which are of a grayish hue. It is only since the year 1868 that the great value of this substance as a fertilizer has become apparent, being now in demand at a rate of 400,000 tons a year.

The modes of treatment, the principal of which is by the use of sulphuric acid, are explained by an attendant. Following is a description of this deposit as given by Prof. Guerard, mineralogist for the South Carolina State exhibit: "The phosphate deposit occurs in beds or strata of rough masses of nodules of a size varying from a part of an inch to several feet in diameter, and is associated with numerous fossil bones and teeth. The remains of numerous extinct animals, such as the mastodon, elephant, megatherium, tapir, deer, horse, occur associated with the beds. It is found on the bottoms of the shallow creeks and rivers which intersect the coast, and on the lowlands which form a belt of country running parallel to and from ten to fifty miles from the seaboard.

"The beds are from six to twenty odd inches in thickness, and the limit of a workable deposit is eight feet underground and twenty feet under water. The phosphatic nodules are known as land or river rock according to the element in which they are found. The average yield of the land deposit is from 600 to 800 tons per acre; and though sometimes occurring in "pockets," that is, irregularly, these deposits are remarkably uniform, many contiguous acres often containing a phosphate bearing stratum at an accessible depth. The river rock having been washed into the rivers from the land, has occasionally accumulated in thicker beds than the original deposit of land rock. The river rock is obtained by dredging, chiefly in the Bull, Stono, and Coosaw rivers; the land rock is dug mainly in the section of country lying between the Ashley and Stono rivers and Rantowle's Creek. Extensive strata of excellent quality are also known on the banks of the Edisto and between the Edisto and Ashepoo rivers, but this deposit has not yet been worked to any extent. Carolina phosphate is remarkably uniform is composition, containing on an average from fifty-five to sixty-one per cent tricalcic phosphate and from five to eleven per cent of carbonate of lime. Among its other constituents are silica, oxide of iron, fluorine, sulphuric acid, traces of alumina and magnesia, water, and organic matter."

In regard to the vexed question whether or no the great fair shall be closed on Sundays, the managers have decided, and, it would seem, very wisely, that those of the exhibitors who choose to show their exhibits may do so, and those who do not so choose may cover them over. The machinery, however, will not be started during the Sabbath.

### Japanese Dentistry.

The Japanese dentist does not frighten his patient with an array of steel instruments. All of his operations in tooth drawing are performed by the thumb and forefinger of one hand. The skill necessary to do this is only acquired after long practice, but once it is obtained the operator is able to extract a half dozen teeth in about thirty seconds without once removing his fingers from the patient's mouth. The dentist's education commences with the pulling out of pegs which have been pressed into soft wood; it ends with the drawing of hard pegs which have been driven into an oak plank with a mallet. A writer in the *Union Medicale* says that no human jaw can resist the delicate but powerful manipulation of the Japanese dentist.

## ENGINEERING INVENTIONS.

A rotary engine has been patented by Messrs. Charles H. Melville and Thomas W. Brown, of Chattanooga, Tenn. It has a radially operating abutment with an eccentric revolving steam actuated hub for utilizing steam pressure to maintain steam tight contact of the abutment with the hub, and also has an improved contrivance for an automatic variable cut-off.

A sextant has been patented by Phillippe Leuba, of Rue der Nord, No. 4, Aigle, Canton of Vaud, Switzerland. This invention covers a novel construction in which there are two artificial horizons, one for taking elevations and the other for taking depressions, and in which provision is made for the use of the sextant in the dark or at night.

A valve gear has been patented by Mr. James A. Stout, of Belleville, Ill. This invention covers novel combinations of mechanisms whereby the engineer has to control but two instead of three handles to give three movements, and dispenses with one of the eccentrics, its strap and connecting rod, also the link and link block with its rock shaft and connections.

A leveling rod has been patented by Mr. Robert B. Seymour, of Willet's Point, N. Y. It is made with a friction roller connected with the keeper that connects the target with the rod, so that the target can be easily and accurately adjusted upon the rod, the friction roller being so arranged that it can be readily adjusted to bear with any desired force against the rod.

A car coupling has been patented by Mr. David C. Barton, of Rocheport, Mo. This invention covers a combination of drawhead and coupling pin, with levers pivoted to the car on either side of the coupling pin, and forked at their adjacent ends, with other novel features of construction and arrangement of parts.

## AGRICULTURAL INVENTIONS.

A sulky cultivator has been patented by Mr. Edward F. Husk, of Malden, Mo. This invention covers novel features in a machine on which a driver may ride while the machine straddles a row of growing corn, to plow or cultivate the earth on both sides of the corn, and to cut the corn stalks into short pieces after the corn has been gathered.

A grain separator and cleaner has been patented by Mr. Edward Sherman, of New Pendington, Ind. This invention covers novel features in a machine for separating grain and seeds, and for grading wheat so as to obtain the seed wheat separately, all the seed wheat being saved and separated from the grain passed through as it comes from the thrashing machine.

A hilling plow has been patented by Mr. Rudolph Schuster, of Waldeck, Texas. This invention covers special features of construction for plows with a double or right and left hand mould board for throwing soil from both sides of a furrow to form beds or hills, and the plow point is held securely in position with the use of only one bolt.

A corn planter has been patented by Mr. William L. Rucker, of Martinsville, Mo. The object of this invention is to provide a mechanism which may be easily controlled by the driver from his seat for allowing or preventing the dropping of seed, and for setting the mechanism to insure planting in accurate check row. the machine being also adapted for planting in drills.

A hay carrier has been patented by Mr. Thomas C. McNichols, of Belmont, Ohio. A self-acting brake is provided for retaining the carrier in place at any desired point while a load is being raised or discharged, and by a combination of levers the brake is made self-regulating in its action, while the carrier can be reversed so as to be operated in either direction from any point of the track.

A combined band cutter and feeder for thrashing machines has been patented by Mr. Richard Harding, of McGaheysville, Va. The object of this invention is to facilitate the feeding of grain to thrashing machines, and it covers an angular vibrating feed spout, a rotary band cutter; one or more grain spreads, an endless apron, and a rotating reel, with various novel features of construction and arrangement.

An adjustable cultivator shovel has been patented by Mr. Myron A. Twitchell, of Kingsley, Iowa. This invention provides a shovel or tooth for cultivators capable of doing service with all of its four sides or four corners forward, or with any side set at any desired inclination to the line of travel, so the plow is adapted to do a great variety of work in both right and left handed plowing.

A combined cotton chopper and cultivator has been patented by Mr. Lemuel Z. Grigsby, of Minden, La. The frame carries a cylinder with central annular groove, with adjustable knives on its face and can concaves in its ends, operating levers connected at their rear ends by a crossbar pivoted to a crank carrying the chopping hoe and its standard, whereby stalks, vines, etc., at the sides of the plants will be cut up, the soil mellowed, and the plants brought to a stand by the passage of the machine along the rows.

## MISCELLANEOUS INVENTIONS.

A culinary vessel has been patented by Mr. Thomas G. Beaham, of Zanesville, O. This invention covers a special construction of an earthenware vessel supported by a metal base in such a manner that both can contract and expand independently.

A hitching strap has been patented by Mr. Samuel Birdsall, of Susquehanna, Pa. This invention covers a coupling device of novel construction for attachment of the brace strap, and is an improvement on a former patented invention of the same inventor.

An album clasp has been patented by Mr. Ernst P. Hinkel, of Offenbach-on-the-Main, Germany. This invention covers a novel device of grooved disk and slide to render the clasp extensible, so that it can be lengthened and adjusted according to the thickness of the album.

An envelope has been patented by Mr. George W. Crane, of Topeka, Kan. The free edge of the flap is inclined from one corner to the transverse center line, and from this point extends to the opposite side of the envelope in a line parallel with the longitudinal edges.

A button has been patented by Mr. Edward Berman, of London, Middlesex County, England. It has an apertured head, with its under surface recessed, a shank held in the recess, and an ornamental disk between the head and shank, so that a material of a different nature from that of which the button is made is held in the button and shows in its face.

A corner iron for wagon bodies has been patented by Mr. Edward Hutchinson, of New York city. It is designed to be made of Russia iron struck up in a novel form to give a firmer hold upon the body, with increased strength, while it can be made lighter than when made flat in the ordinary way, and is also applicable for corners of wagon seats.

A combined spring jack and annunciator has been patented by Messrs. Louis Townsend and Robert W. Moore, of Evansville, Ind. This invention consists in the combination of these two features on the same frame, to make them both occupy only the space of one, thereby saving half the space in the telephone switchboard.

A tricycle has been patented by Messrs. Thomas P. Hall and James B. Hall, of Toronto, Canada. Combined with a frame is a shaft journaled in its rear, on which are the driving wheels, the shaft and wheels being revolved by gearing from levers pivoted to the front of the frame, and there is provided a novel device for steering.

A binding attachment for sewing machines has been patented by Mr. Robert Hilguer, of New Orleans, La. This invention relates to a former patented invention of the same inventor, and covers several features of improvement thereon designed to secure better work and a more convenient and complete system of adjustment.

A combined truck and ladder has been patented by Mr. John C. Lowen, of Titusville, Pa. The ladder, as formed in connection with the truck, is easily moved when needed in the form of a truck, and then readily adjusted so as to form a step ladder, a combination which may be quickly reversed, so as to form a truck on which to convey goods.

A folding wardrobe and chiffonier has been patented by Henrietta L. Mehrer, of New Rochelle, N. Y. The invention combines with a chiffonier a detachable folding wardrobe provided with spring catches adapted to catch on slotted plates on the chiffonier, so the chiffonier and wardrobe can easily be united or detached.

A combined annunciator and spring jack has been patented by Mr. Louis Townsend, of Evansville, Ind. This invention consists chiefly in constructing the magnet which operates the annunciator drop with a hollow core and placing in this hollow core the spring jack, the combination being such as to make a single compact device, which will economize space.

A clockwork for mechanical lamps has been patented by Messrs. Frederick Cook and John H. Pomeroy, of New Haven, Conn. It is made with the fan shaft connected with the gear wheels of the clockwork by an elastic driving band of rubber or similar material, to prevent the fan driving band from exerting an injurious side draught upon the fan post.

A post hole auger has been patented by Mr. Alexander C. Osborn, of Clarksburg, West Va. Combined with the central stem are separate blades, with fixed and adjustable connections with the stem, there being also an adjustable disk, braces, and nuts, whereby the dirt may be withdrawn from the hole made by the auger and prevented from falling back.

A game has been patented by Mr. Paul K. Dealy, of Brandon, Manitoba, Canada. Combined with a plate or disk having recesses in its upper surface is a standard in the top of which a lever is pivoted, on one end of which a cup is formed; by striking a lever a marble or pellet in the cup is thrown up, and as it drops or not in the recesses of the disk the game is counted.

A machine for grading shot has been patented by Mr. Christopher C. Tracy, of New York city. It has plain cylinder drums with perforations all of the same size in each drum, there being as many drums as there are separate sizes of shot to be separated, and it is feasible to set the drums at any desired pitch to increase or diminish the speed with which the shot pass through.

A washing machine has been patented by Andrew J. Guffin and Matilda C. Guffin, of Rushville, Ind. A wash boiler of two or more sections has independent drums or wash wheels journaled therein, with a clutch mechanism for engaging and holding the shafts together, so the wheels may be operated separately or together, and two batches of different kinds of clothes may be washed together.

A composing stick for type setters has been patented by Mr. William Hendrickson, of Brooklyn, N. Y. It is made with a recessed knee, with lever clamps having their inner arms overlapped and their outer arms bent to overlap the under side of the bottom of the stick, and made to clasp the bottom by a hand screw, so the knee can be readily adjusted in any desired position.

The manufacture of wire coated articles forms the subject of a patent issued to Mr. Emil Kellermann, of Cincinnati, O. This invention consists in coating the ends of wires in the form of bulbs, by repeated dipping in an adhesive substance, and covering the same with a granular or flocculent material, in order to give an ornamental appearance to vases, baskets, and similar articles.

A rope socket has been patented by Mr. John H. Banser, of North Clarendon, Pa. It is a clamping socket of novel construction, affording increased facility for coupling and uncoupling of the rope by which the drill used in boring oil and other wells is raised and lowered, the screwing or unscrewing of certain parts serving to secure or release the hold of the socket upon the rope.

A corkscrew has been patented by Mr. Bartholomy Wilhelm, of Appleton, Wis. This invention consists in the combination, with a corkscrew, of two loose prongs between which the screw is adapted to revolve, and of a sliding ring surrounding the prongs and serving to hold their lower ends a greater or less distance apart, according to the size of the head of the bottle.

A doubling spooler has been patented by Mr. Leonard V. Richmond, of Sand Lake, N. Y. This invention is for facilitating the doubling of yarn upon upright and drum spoolers from cops, spools, and bobbins, by providing a mechanism that will stop the receiving spool automatically should one of the threads break or one of the spools become empty, thereby economizing time and preventing waste.

A curtain pole knob has been patented by Mr. David B. Olmstead, of New York city. This invention covers, as an improved article of manufacture, a curtain pole knob cast in metal or metal composition, and having its exterior surface metal plated, whereby elaborate designs may be made easily, and such as cannot be readily made in stamped, spun, or hammered work.

A saw filing machine has been patented by Mr. Hamilton Sherman, of Waverly, Pa. This invention consists in particular constructions of the machine frame to allow its dismemberment, and of the file frame guide, with a base plate sliding on a guide bar and with a head piece pivoted to the base plate, so as to be movable in horizontal plane, with other novel features.

A shawl strap has been patented by Laura A. Beatty, of Galesburg, Ill. With two bars having handles, straps are secured to one bar and passed through loops on the other bar, the bars being provided with means for holding them together, the shawl, etc., being held by the straps, the device also holding parcels firmly, and permitting of readily removing and replacing the shawl.

A trunk has been patented by Messrs. Oliver R. Meredith, James I. Gallacher, and Charles F. Jones, of Salt Lake City, Utah Ter. This invention covers a trunk corner piece provided with a hasp, and a corner piece with a hook lug over which the hasp can be passed, the first mentioned corner piece being secured on the corner of the trunk body and the other on the cover.

A fire escape has been patented by Mr. Thomas P. Hall, of Toronto, Canada. Combined with a reel or pulley, on which is wound a cable or wire, is a frame on which the pulley is pivoted, and a brake lever pivoted in the bottom of the frame, a belt being suspended from one end of the lever, making a fire escape which is compact, strong, and durable, and one which can be carried in the pocket.

A drawer has been patented by Mr. Michael Meyer, of Waukesha, Wis. The invention consists of a pair of intermeshing toothed sectors pivoted to fixed cleats or crossbars of the drawer frame and to the drawer by links, so a parallelism of movement of the drawer is secured, so the drawers will be compelled to move alike at both ends as they are drawn out from and slid back into closed position.

A machine for making and twisting chain links has been patented by Mr. Charles H. Reinisch, of New York city. It comprises a revolving mandrel, over which the links are shaped, stationary and movable cutting edges for cutting the links, and means for grasping and holding and at the same time twisting the links, the holding bar automatically adjusting itself to any irregularity in the rod or wire from which the links are being formed.

A baling press has been patented by Mr. William T. Anderson, of Rock Hill, S. C. The upper part of the press box is made vertically adjustable, and there is an arrangement of the pull ropes or chains of the follower to wind on tapering drums, to lessen the downward movement of the follower for each successive stroke of the operating levers as the compression increases in forming the bale, and to correspondingly increase the leverage of the levers, with other novel features.

## 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.

**Names and Address** must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

**References** to former articles or answers should give date of paper and page or number of question.

**Inquiries** not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

**Special Information** requests on matters of personal rather than general interest, and requests for **Prompt Answers by Letter,** should be accompanied with remittance of $1 to $5, according to the subject, as we cannot be expected to perform such service without remuneration.

**Scientific American Supplements** referred to may be had at the office. Price 10 cents each.

**Minerals** sent for examination should be distinctly marked or labeled.

(1) E. J. C.—In the reports for 1883, locomotives upon the following railroads and branches were for—

| | |
|---|---|
| D., L., and Western | 436 |
| Pennsylvania | 1105 |
| N. Y. Central | 632 |
| N. Y., L., E., and Western | 564 |
| Baltimore and Ohio | 571 |
| Denver and Rio Grande | 222 |
| Northern Pacific | 230 |

The Pennsylvania Railroad has the heaviest passenger locomotives.

(2) J. S. asks how cosmetique is made, colored black, and perfumed. I want it to be pretty hard, and so that it will not wipe off of the hair easy. Please give me the component parts of it. A. The following are recipes for white cosmetiques:

| | |
|---|---|
| 1. Benzoinated suet | 1 pound. |
| White wax | 1 " |
| Jasmine pomatum | 8 ounces. |
| Tuberose pomatum | 8 " |
| Otto of roses | 1 drachm. |

Melt at a gentle heat, and cast into moulds.

| | |
|---|---|
| 2. Suet | 1 pound. |
| Paraffin | 8 ounces. |
| White wax | 2 " |
| Oil of bergamot | 1 " |
| " " cassia | ½ drachm. |
| " " lavender | 1 " |

To make black or brown cosmetiques, the appropriate pigment, finely ground in the smallest possible quantity of oil, is added to the melted grease just before it is poured into the moulds. Lampblack or ivory black is used for the first, and burnt umber for the second color.

(3) A. E. M. writes: 1. How is it that sunrise and sunset do not occur on the same day at equal distances from 6 o'clock? I always had a general idea that the first took place just as much before 6 A.M. as the second did after 6 P.M., and *vice versa*, till actual observation and subsequent reference to an almanac convinced me of my error. A. The sun does not always keep time with the clock or mean time. This is caused mainly by the elliptic orbit of the earth, and apparent time is faster or slower than the true time, as you will see indicated in the almanac. 2. Would this fact influence the accuracy of a N. and S. line found by bisecting the angle between the shadows cast by a pole when the sun is at equal heights above the horizon before and after noon? And, if so, can this be remedied? A. The shadow of a north and south line is influenced by as much as the difference in time indicated by the almanac, which should be allowed for; or observe and mark the shadows as much earlier as the sun is fast, or later than the sun is slow. The bisection of the shadows will then give the true meridian. 3. I used a small quantity of a solution of chloride of iron for purifying turbid water, but obtained no result. The iron gathered into flake-like particles of a rusty color. Why was this? A. Iron perchloride and sodium carbonate, in the proportion of 10 parts by weight of the former salt and 26½ of the latter to a quantity of water equal to 20,000 parts, is the best compound for purifying water. The salts alluded to are best previously dissolved in some pure water, and the solutions, that of iron first, poured into the tank containing the water intended to be operated on. The soda solution is not added until a few moments, the water being first vigorously stirred. The soda solution having been added, the fluid is stirred again, and then left quiet for the purpose of allowing the very bulky and flocculent sediment to deposit; this takes considerable time—from 24 to 36 hours. Such in brief is the outline of the process used to clarify the water of the Mississippi, one of the most turbid rivers known. 4. I wish to dam up a small valley to collect rain water in. In dry weather, there will be no flow in it, though its surface will be continually agitated by the breeze. Is there any danger of its becoming stagnant and unhealthy? A. Your pond will no doubt become covered with vegetable growth, and harbor a variety of animalcules and insect larvæ. The mere growth of vegetable matter such as water plants, algæ, desmids, etc., does not imply unhealthiness. If by filth fermentation sets in, we should consider the water unfit for use. This you can readily know by the smell.

(4) D. P. H. asks for a receipt for some solution which can be used to write on "blue prints," and which will take out the color, so that the writing will appear white or nearly so. A. Use dilute hydrochloric acid. It is probable that the vegetable acids will also act.

(5) E. F. McI. asks how to make an article to be used in mending and sticking torn bank notes together. A. Take thin tissue paper, and coat it with a dilute solution of gum arabic. Let the paper dry, and then by moistening it with the lips it can be readily affixed to the torn portions of the bill.

(6) C. N. asks the best way to paint wire and tin birdcages, and what kind of paint and varnish to use, and state if it must be done by heat. A. Paint with zinc. Do not use lead. The zinc can be given any desired tint. It is then coated with light polishing copal varnish, after which it is baked or heated at from 100° to 150° Fah. The varnish known in the trade as "extra light polishing varnish" is used by several of the prominent birdcage makers.

(7) T. C. asks if there is a cement for mending or sticking a leather sole to what is called the gum boot. A. Use equal parts pitch and gutta-percha fused together, and apply hot, or else take 1 pound gutta-percha, 4 ounces caoutchouc, pitch 2 ounces, shellac 1 ounce, linseed oil 2 ounces, and melt together. This cement must be melted before using.

(8) J. T. I. writes: Will you please inform me how to prepare cotton sheeting on canvas or linen, that it may be written upon without the ink spreading? A. Apply to the fabric a preparation of gum (gum arabic and water) and allow it to dry, then press the place with a moderately hot iron. If the fabric is glazed or starchy, it is best to wash out the starch before applying the preparation.

(9) C. C. B. asks: What will prevent soreness from shaving, and toughen the skin. A. The following is frequently used: Take of potassium cyanide 6 grains avoirdupois, glycerine ½ ounce, strongest camphor water 2½ ounces; mix. The foregoing is poisonous, and it must only be very cautiously used. The white powder or cake frequently used by barbers is magnesia and can readily be procured from a druggist. Bay rum is also used.

(10) G. A. R. asks: 1. What sort of potash is used to burn warts and corns off? A. Potassium hydroxide, or, as it is commonly called, caustic potash. 2. What sort of potash should be used with tartaric acid, so as to form a bitartrate of potash? A. The bitartrate can be formed by adding tartaric acid in excess to any soluble potassium salt. 3. In what number or numbers of the Scientific American does it describe electrotyping? A. See Scientific American Supplement, No. 310.

(11) G. D.—In order to render glue insoluble in water, even hot water, it is only necessary when dissolving the glue for use to add a little potassium bichromate, to the water and to expose the glued part to light. The proportion of potassium bichromate will vary with circumstances; but for most purposes about one-fiftieth of the amount of glue used will suffice. In other words, glue containing potassium bichromate, when exposed to the light, becomes insoluble.

(12) A. E. L.—1. The cores of your magnets should be as soft as possible. The size of wire with which they should be wound depends upon the kind of current you propose to use; if it is a quantity current, No. 14 will be right; but if it is an intensity current, you should use a smaller wire, say No. 16 or No. 18. 2. Shellac is a better insulator than sealing wax. The depth of winding magnets should not exceed the diameter of the core. All of the cores may be wound in the same direction.

(13) M. E. H.—The porous cell of the regular Leclanche battery is charged with granulated black oxide of manganese. Makers of similar batteries sometimes employ a mixture of equal parts of black oxide of manganese and granulated carbon, and others use the carbon alone, but the manganese produces the best results. Porous cells are made of unglazed pottery.

(14) O. G.—$CS_2$ (disulphide of carbon) is a liquid, insoluble in water and will not mix; will mix with alcohol. Cannot be deodorized. It is its strong odor that gives it its power as an insecticide.

(15) B. W. S.—One of the best means of guarding against burglars that we know of is the ordinary well-known electric burglar alarm.

(16) R. B. C.—Several writing telegraphs have been patented, but none of them are now in practical use. You will find several of them described in back numbers of our Scientific American and Supplement.

(17) T. B.—We believe that the usual gas pressure is equivalent to a column of water two inches high, but much depends on the various heights of service and supply and extent of the mains.

(18) W. P. H.—Nothing can be added to kerosene to alter its character. Whether powders are harmless or not depends upon their composition.

(19) J. E. H.—The Bell telephone company claims to control all electric speaking telephones. If we understand your diagram, your proposed improvement is not new; wind the armature with No. 18 wire, and the field magnets with No. 16 wire.

(20) E. C. C. asks with what substances phosphorus has to be combined, and in what proportions, and to be placed on glass so as to make an illuminator? I have an illuminating match safe, but I want to make one larger and more powerful. A. The article you refer to is not a combination of phosphorus, but of calcium and sulphur, known as luminous paint.

(21) L. H. S. writes: Can you tell me of any way to bleach hair of any color white? A. Use hydrogen peroxide. A full description of its properties and methods of preparation and use are given on page 5408 of Scientific American Supplement, No. 339.

(22) P. H. R.—We are not familiar with the composition of the dog powder mentioned. It can doubtlessly be obtained by submitting samples of it to some competent chemist for analysis. The imitation stained glass consists of very thin sheets of porous paper felt. The colors are probably first printed on the paper, which then is made transparent by being waxed. The exact process of manufacture is kept secret by the owners of the process.

(23) H. R. C.—Ink stains are removed by bringing the constituents of the ink into solution, and then washing the solution away. Most inks are compounds of iron, and solutions in which iron is soluble are therefore used. As to the glaze, even cold water will injure that. A little gum water will sometimes restore the glaze.

(24) W. M. asks: What size carbon pencil will I require to make electric lamp of the Werdermann's electric lamp pattern, to give about 50 candle power? Also how many cells of Grove batteries will give such light, and if the Grove is the best for such purpose? A. The carbon should be about three-sixteenths of an inch in diameter. It will take about 25 cells of Grove or Bunsen battery. The latter is preferable.

(25) C. W. S.—Brass is generally used with iron for a compound expansion bar.

(26) T. W. K. asks the cause of a battery called "the American Electrizer" failing to impart any electrical current when the conditions mentioned have been complied with? Bisulphide of mercury is put in the battery to produce the current. It is used simply for imparting electricity to any person holding the handles. A. Write to the manufacturer of the battery. 2. How thick is treacle? A. Treacle is molasses; judge for yourself. 3. If an egg be placed in a warm place, will it hatch? A. Yes, if it is fertile, and the temperature is well regulated. 4. Can a magic lantern be of any use or good if it cost only $1? A. We have seen very good magic lanterns for $1.00.

(27) J. W. S. asks (1) how to make a ground connection for a telegraph line where there are no water pipes to connect on. A. This is generally done by burying a plate of copper, having an area of about 10 square feet, in earth that is constantly moist, and connecting the ground wire to it. 2. Does it have to be any particular kind of metal? A. Other metals might answer, but copper is the best, both on account of its conductivity and durability.

(28) Kanoum.—You can use batteries to generate the current required to light your house, but it would be very expensive and troublesome; better purchase a steam engine and dynamo electric machine. Possibly you might use secondary batteries, and charge them with a voltaic battery. Crocodile skins are not used in this country. The alligator skins from the native swamps and lagoons of Florida and Louisiana furnish supplies for several tanners.

(29) O. D. W.—It is supposed that in applying creosote and paraffine for the preservation of buildings, the creosote acts as an antiseptic to any fungoid growth in the pores of the stone, preventing both decay and growth of organic matter, the proportion of creosote varying according to the conditions.

(30) A. V. R. and many others.—It will not be satisfactory to attempt to make liquid shoe polish solely from a formula which any chemist can furnish. There are many details in the manufacture which a simple knowledge of the original ingredients throws no light upon, and these details can only be worked up to a practical success by careful study and intelligent application. One of the largest manufacturers of shoe dressing in the United States lost thousands of dollars some three years ago by putting out an article, notwithstanding his long experience in the business, which he failed to make "all right," though the chemical formula seemed perfect.

(31) A. P.—To render aniline inks indelible on paper, it will be necessary to coat the reproduction with some preparation. An excellent compound consists of collodion dissolved to the consistency used by photographers with two per cent of stearine added. The following ink is recommended for marking linen: Triturate 1·75 drachms aniline black with 240 drops strong hydrochloric acid and 42 drachms strong alcohol. The mixture is diluted with a hot solution of 2·5 drachms gum arabic in 170 drachms water. We would recommend experimenting on the above formula with the various colors used by you. It is impossible to furnish any positive information on such matters without first engaging the services of an expert dyer to experiment on the matter. Rosin and salt are added to soap mixtures in order to produce a harder compound.

(32) H. R. W.—It is possible to supply 25 incandescent lamps by means of a battery; the number of cells required will depend upon the size or resistance of the lamp. When the lamps fail, nothing remains of them that is of any value. Light produced by incandescent lamps fed by batteries is much more expensive than gas, and very unreliable and troublesome.

(33) Q. P.—We think your tin foil is too heavy. It is possible also that there may be some imperfection in your needle point; the needle should be capable of longitudinal vibrations only, and its point should be like that of a leather-sewing needle, and quite sharp. You would be likely to find a phonograph at some of the stores where optical and philosophical instruments are sold. The Supplement referred to contains the most elaborate description that we know of.

(34) O. C. R.—If you desire to go into electric lighting to the extent indicated by your letter, we advise you not to follow the description of a small dynamo referred to, but to copy some of the later machines—Edison's, Weston's, or Siemens'. You can obtain full information on construction of dynamos by consulting back numbers of the Supplement, or Gordon on Electric Lighting, Schelling on Dynamo Electric Machines, or Prescott on Dynamo Electricity. You can employ the water pipe for a ground or return; we do not think the current from a small dynamo such as you propose to make would be liable to injure any one. It would probably have no effect on incrustations of the pipes. You can get the materials you require or the machine itself from the Western Electric Company, of Chicago, Illinois. Bare wire will do for your conductor.

(35) B. F. N. writes: I require for my work a glue or cement that is as nearly waterproof as possible. I have tried several kinds of glue, and have at last, after nearly seven years, found a cement that is better than anything I have yet been able to buy, which I make myself. It is composed of Cooper's best white glue (I am obliged to have it light colored), dry white lead, shellac and alcohol, and ammonia. I am obliged to use heat to dissolve it. Can you tell me of anything to add to this solution to keep it in a dissolved condition when not exposed to the air, or can you name a solution that is waterproof and in a liquid state that will answer my purpose. I also would like it to cement leather together, etc.; those now in the market do not answer my purpose. A. A waterproof glue may be prepared by adding a small proportion of potassium bichromate to the glue before it is melted, and then exposing the glued portions of the article to the light. The liquid glues are produced by the action of nitric acid. Thus white glue, 16 ounces; dry white lead, 4 ounces; soft water, 2 pints; alcohol, 11 ounces; stir together and bottle while hot. The leather cements consist of shreds of gutta-percha dissolved in some suitable substance, generally carbon disulphide or ether, until the consistency of honey is reached. The surfaces to be united are pared down, heated, and the cement applied. See the receipts given for various cements in Scientific American Supplement, No. 158.

(36) A. M. S. writes: What material or lining for tanks and their discharge pipes will enable them to resist for some years the action of acids and other chemicals employed in metal working manufactories where iron, copper, lead, stoneware, and tarred wood have failed? Or of what material should a tank be made to resist action of a pickle for steel forgings, composed of dilute muriatic acid and zinc? A. We know of nothing but glass and paraffine that will stand when the articles named have failed. There is no reason why hard glazed stoneware will not stand (not salt glazed); perhaps part of your difficulty arises from abrasion by contact from the pieces of steel. Stoneware tanks are made for our chemical companies that hold strong acids.

(37) J. E. writes: I have two wooden rollers covered with leather which I use for running wool through, and am troubled with the loose fibers lapping and sticking to the roller. I am troubled the most in dry frosty weather; in wet weather they run all right. I think it is all caused by electricity; can you tell me of anything that would be of benefit, or would help me? A. This difficulty, we think, has been remedied by others, by making the air damp in the room, which may be done by introducing a little steam jet in or around the machine to keep the air moist, but not to wet anything. The moisture tends to dissipate the electricity.

(38) M. E. O. asks for a formula for a blackboard paint. The formula that I am using does not give satisfaction. The chalk rubs into the board instead of erasing, as it should. A. One of the best preparations for this purpose consists of 1 gallon 95 per cent alcohol, 1 pound shellac, 8 ounces best ivory black, 5 ounces finest flour emery, 4 ounces ultramarine blue. Make a perfect solution of the shellac in the alcohol before adding the other articles. To apply the slating have the surface smooth and perfectly free from grease; well shake the bottle containing the preparation, and pour out a small quantity only into the dish, and apply it with a new flat varnish brush as rapidly as possible. Keep the bottle well corked, and shake it up each time before pouring out the liquid.

(39) J. S. O'B. asks (1) for a receipt for a good strong cement or glue for wood. A. You will find in Scientific American Supplement, No. 158, a number of recipes for cements. Among these there are several suited to your wants. 2. Also a waterproof varnish. A. Let 4 ounces of India rubber in small pieces soften in 8 ounces oil of turpentine, then add 2 pounds of boiled oil, and boil for two hours over a slow fire. When dissolved add 6 pounds of boiled linseed oil and 1 pound of litharge, and boil until an even liquid is obtained. Apply warm. 3. What liquids are the best non-conductors of electricity? A. Water and solutions of neutral salts have the lowest conductivity.

(40) An Honest Workman writes, asking information concerning the coloring of cabinet photos. A. In outline, it consists simply of first carefully separating the photograph from the cardboard, then coating the face of the print with tragacanth paste. The picture is next attached to the glass, and then made transparent by immersing in the transparent compound, which must be purchased. Finally the picture is painted, and last of all backed, etc.

(41) J. W. L. writes: My Canada balsam has become oxidated on the top, and when melted on the side has innumerable air bubbles in it, which are next to impossible to remove. Is benzole the best liquid to reduce it with? A. If the Canada balsam is too thick, it can be reduced with benzol. It is also soluble in rectified oil of turpentine and in warm alcohol. For your purpose it will probably be best to first melt it and then add the benzol.

(42) O. C. D. asks (1) if it is dangerous to work over a boiling solution of sulphide of potash heated in a moving sink heated with a coil of wrought iron pipe. I sometimes feel a bloatedness in my stomach after it, as though I was filled with a gas. A. In all probability the gases emanating from the mixture, such as hydrogen sulphide, are poisonous, and the ill effects experienced by you are due to them. 2. Can aniline colors be used to color spirit lacquers? If so, how? A. Aniline colors are as a general thing soluble in alcohol, and therefore can be directly incorporated in the spirit with which the lacquer is made.

(43) W. S.—The tone of steam whistles depends on quality of the metal, thickness of the wall of the bell, and size (diameter and height) of the bell. Position in regard to the annular aperture for the escape of the steam does not affect the tone.

(44) G. M. V. has a gun barrel that has been defaced by being indented by a charge of buckshot; how shall he get the dents out? A. Filing around the depressions, and repolishing. The old time gunsmith's trade is of the past; we know of no manual on the subject.

(45) O. T. H. asks: How are gun mountings colored different shades? A. By heating them in a hot sand bath, after being polished, and quenching in water when the desired shade is attained. Barrels are colored (browned) by rusting with acid. The Damascene mottling comes from the coils of different colored wire of which the barrels are made. 2. Are breech loading guns (barrels) made of iron casehardened or of steel? A. Shotgun barrels are usually of iron—never casehardened. Rifle barrels are of steel—never hardened.

(46) A. K. C. asks: Does steel rolled into sheets, rods, shafts, and rails, and drawn into wire, acquire a fiber by its working? A. Yes.

(47) C. G. T. M.—We think you will succeed very well in plating articles by adding to tin a very small proportion of bismuth and antimony. The articles to be plated are first to be thoroughly cleaned by dipping them in a solution of caustic potash, then scouring them with washed emery, then thoroughly cleansing them with clean water, then brushing them with a solution of zinc chloride or soldering fluid, after which they are washed with a clean cloth and dried and plunged into the melted alloy, which should be covered with tallow to prevent the oxidation of the surface of the metal. With these few hints we think you will have no trouble in applying the tin to the articles you desire to plate.

(48) G. B.—We have no knowledge of any newly discovered metal that is of a silver color that is likely to come into general use. Most of the newly discovered metals have fabulous values. See values in Scientific American, January 3, 1885, page 7. Aluminum is the only metal likely to come into general use that is white like silver, and may take a valuable place in the arts. A company in Philadelphia attempted to manufacture it by a new process which it was supposed would bring its value to a working basis. So far as we are informed, they have not yet made it cheap enough to be widely used.

(49) W. D. G. asks how the rubber coverings on band saw wheels is ground or turned true. A. The wheels are turned true, but the bands are made true in a mould, stretched upon the wheels, and fastened with cement. Any truing that may be necessary is done by turning the wheel slowly against a quick revolving sand paper wheel.

(50) J. E. M. says: Will you please let me know in your next issue, what is the cheapest article that will remove the smell of coal oil from clothing? A. Evaporate the oil by placing the clothing for a sufficient time before an open coal fire. The higher the heat the better, taking care not to inflame the goods.

(51) A. L. J.—A turbine exactly suited to your supply and height of fall is said to give the largest percentage of power.

(52) J. Y. S.—The impinging of feed water upon the flue or tube head subjects it to changes of temperature, and consequently, by local expansion and contraction, disturbs the joint. We recommend the feed pipe placed so as to terminate near the surface of the water, preferably at the side near the center of the tube space.

(53) J. A. R. asks a good plan for refining ordinary "refined solder," or half and half, so that it will make a good smooth wiped joint. Every now and then the metal gets coarse, the joints look rough and sweat. A. The metal gets coarse from the absorption of lead in wiping the joints. Keep the sulphur away, and add more tin until the quality is restored.

(54) W. A. A. asks where magnetic sand can be obtained, and the prices, if it be an article of commerce, also where loadstone can be obtained. A. Magnetic sand is not a commercial article, and probably can only be procured locally. It is found along the St. Lawrence River. Loadstone comes principally from Arkansas and can be purchased of mineral dealers.

(55) P. B. R.—Britannia metal consists of 1 part tin, 2 parts antimony, 1 part bismuth. Your spelter or zinc will not run well in iron moulds. Use moulding sand. Or for iron moulds, mix with tin until the required fluidity is found.

(56) P. C. C.—Raw hide is made into masses sufficiently thick for spindle bearings, by soaking in water until soft, and then moulding with pressure and drying.

(57) H. W. C.—There is nothing but galvanizing that will prevent pump chains and iron pipe imparting the disagreeable taste of iron rust to water. Any painting or bronzing is impracticable.

(58) D. C. B. asks (1) if the production of barytes is now equal or more than the demand. A. The production of crude barytes in 1882 is estimated to have been 20,000 tons, and "the production could be largely increased to meet an augmented demand." 2. Also where it is mainly produced? A. In 1880 according to the census returns:

| | |
|---|---|
| Connecticut produced | 6,000 |
| Maine | 2,200 |
| Missouri | 4,425 |
| Pennsylvania | 1,500 |
| Tennessee | 465 |
| Virginia | 4,575 |

3. If in your judgment an increased production of 10,000 tons would find a ready market at nearly the present price? A. We cannot express an opinion on this point. A New Haven firm imported during 1882, 4,000 tons of German barytes. We would recommend you to first canvas the market.

(59) J. E. B.—Fusible alloy melting at 212°, tin 3, lead 5, bismuth 8. Fusible alloy melting at 203°, tin 1, lead 1, bismuth 4.

(60) A. D.—Black crocus is not known in the market. Crocus is a crude kind of rouge and is much darker than rouge. Both are made by calcining copperas or sulphate of iron. The crocus not being so highly oxidized as rouge gives it a sharper cut as a polishing powder.

(61) W. S. P.—The corrosion of water gauge glasses takes place to a slight extent under the most favorable circumstances, but in some parts of the United States the water has an excessively corroding power over what are called the Scotch glasses, which are made of kelp or the ash of sea weed and sand. The glass contains much potash, which is quickly attacked by water that is slightly acid, and at the temperature and pressure at which you are steaming your boiler, viz., 90 to 110 pounds pressure, becomes a solvent of silicate of potash. A very small quantity of soda in your feed water, a half ounce to a hogshead or less, will probably neutralize its corroding properties.

(62) W. H. S. asks: 1. What would be correct exposure of a dry plate at 9 A.M., on an object lighted by bright sunlight in December, when the correct exposure at noon would be 10 seconds, all other conditions being the same? A. About one-fourth longer or twelve to thirteen seconds. 2. Would the exposure, under the same conditions, be the same at 3 P.M. as at 9 A.M., and if not what would be the difference? A. Fifteen seconds would be correct, as the light in the afternoon is not as strong as in morning. The noon December sun is as powerful as the June sun at six o'clock P.M. 3. Give length of exposure, same conditions, at noon in June. A. One to two seconds. The time of exposure varies greatly, according to the sensitiveness of the plate, the brilliancy of the lens, and the state of the atmosphere. A thick hazy atmosphere requires more time than one which is clear and crisp.

(63) S. W.—Venus as morning star is sometimes alluded to as the star of Bethlehem. The general opinion among astronomers is that the star of Bethlehem was one of the variable stars that have been seen to expand to great brilliancy for a short time and then disappear. A few such have been seen during the centuries of the Christian Era. The bright morning star now seen is Venus.

(64) T. D. M.—If ball and cartridge are free to move in opposite directions, they will, on exposure of the cartridge, partake of a velocity due to their relative weights for a short distance. If the cartridge is confined so as not to move, the ball will be projected with considerable force, but not in any wise equal to the force as projected from a barrel. Its direction will be very uncertain. We know of no regular manufacturers of gun cotton in the United States. We understand that it was started here, but was not found suitable for general use, and has been superseded by other high explosives, as nitroglycerine, dynamite, etc.

(65) A. C.—Over 50 years ago both Britannia ware and good crockery were made in the United States. It is our opinion that the manufacture of these goods was started during the war of 1812. The composition of Britannia ware has not changed to our knowledge, except for the better, there being now, as of old, several grades or qualities. The first glass made in this country is said to have been at Jamestown, Va., in 1615.

(66) H. F. M.—Rubber goods are vulcanized at a temperature ranging from 250° to 300° Fahr. If you use a steam vulcanizing chamber with direct steam, give 25 to 35 pounds pressure in the vulcanizer, but, in order to insure its proper working, the steam should be much higher in the boiler; and the pressure adjusted in the vulcanizer by a safety valve.

(67) S. T. writes: I wish to use soluble glass as a mineral glue. What can I mix with it to make it more sticky and agglutinative? Which is best for the purpose—silicate of soda, or silicate of potassa? A. Soluble glass is of value as a glue only when it combines with lime, thereby forming an insoluble calcium silicate. The sodium silicate is the cheaper, and therefore more commonly used. The difference in solubility is slight, the potassium silicate being the more soluble. An excellent description of this substance is given in SCIENTIFIC AMERICAN SUPPLEMENT, No. 317.

(68) F. S. W. asks what materials are used, and how are they used, in a Babcock fire extinguisher. A. The principal liquid used is a solution of sodium carbonate; when the extinguisher is brought into active service, a smaller receptacle containing sulphuric acid is opened, so that these two solutions generate carbonic acid gas when they melt.

(69) H. N. writes: Our wards and hall floors (Soldier's Home), Washington, D. C., have been stained with Vandyke brown and waxed; they are five or six years old; near the doors where the tread has been heavy the boards are worn and the stain is worn away, but by continually waxing the wood is so impregnated that I cannot make these places dark again. Is there anything that will go through the wax and sink into the wood and stain the boards again? I have tried Vandyke brown and vinegar put on hot, but it only washes the wax from the surface and will not soak into the wood. A. We would recommend you to wash the locality with turpentine until as much wax as possible has been dissolved away, then apply a mixture of turpentine and asphaltum. This, you will find, will darken the wood work in harmony with that previously stained.

(70) H. S. asks how to ink ribbons for for the type writer, and the materials for the colors or dyes. A. An ink for the type writer ribbons can be made as follows:

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|---|---|
| Aniline black or violet | ½ oz. |
| Pure alcohol | 15 " |
| Concentrated glycerine | 15 " |

Dissolve the aniline in the alcohol and add the glycerine.

(71) S. & E. C. H. asks for recipes for making the so-called "patent rubber composition." A. The following will probably prove satisfactory:

| | |
|---|---|
| Cooper's best glue | 8½ lbs. |
| Extra sirup | 2 gals. |
| Glycerin | 1 pint. |
| Venice turpentine | 2 oz. |

Steep the glue in rain water until pliant and drain it well. Then melt it over a moderate fire, but do not "cook it." This will take 15 to 25 minutes. Next put in the syrup, and boil for three-quarters of an hour, stirring it occasionally and skimming off impurities rising to the surface. Add the glycerine and turpentine a few minutes before removing from the fire, and pour slowly. Slightly reduce or increase the glue as the weather becomes colder or warmer.

(72) C. F. A. asks: (1) How may eight or ten ounce duck be waterproofed and colored a dead grass color, suitable for hunting coats or suits? A. For waterproofing, use a solution of rubber in coal tar benzol, and suspend in this mixture a small quantity of burnt umber (in proportion to produce the desired shade). In applying to the duck stir it up thoroughly. 2. Will chilled shot wear the choke of a Damascus barrel shot gun worse than soft shot? A. No. 3. By what process are chilled shot made? A. The chilled shot are produced by adding a greater amount of tin to the composition with which the shot are coated than is the case with soft shot. 4. How much lighter in weight are chilled than soft shot? A. As far as we are able to ascertain there is not any difference. 5. What is the diameter of 10, 12, and 16 bore guns?

| | |
|---|---|
| A No. 10 equals | $\frac{27}{32}$ of an inch. |
| No. 12 " | $\frac{25}{32}$ " " " |
| No. 16 " | $\frac{23}{32}$ " " " |

(73) W. A. P. writes: 1. Give me a simple receipt for telling oleomargarine from butter? A. There is no very satisfactory test by the use of which butter can be distinguished from the genuine article. Determinations of the melting points of the two articles are sometimes employed. Microscopic examination is frequently resorted to. It is said that fresh genuine butter which has been melted appears under the microscope composed of ovoid granules, and contains no crystals. The artificial product contains crystals. Artificial butter does not melt at once, like genuine butter, to a clear oil, but fuses gradually, a whitish sauce being first formed. 2. Tell me if there is anything you can put in white lead to give it a permanent gloss, as oil soon loses its gloss? Will oil and varnish answer for outside work? A. Old heavy oil is the only thing that can be used to produce the gloss. Varnish is sometimes used, but will not stand.

(74) G. W. R. asks: What size engine and boiler will be required for a boat 15 feet long and 5 feet wide, a paddle wheel boat? Also, how thick the shell of boiler and head should be, and how many pounds of steam it will hold, and what power engine it would be? A. It is a very rare thing to see a paddle wheel boat so small as you name. We think an engine 3 inches diameter of cylinder and 5 or 6 inches stroke would suit. About 2¼ horse power. Boiler should have about 30 feet heating surface. After fixing the dimensions of the boiler, apply to the steamboat inspectors for the thickness of iron required.

(75) A. O.—The only device that we can suggest to ignite by a blow is a bit of phosphorus wrapped up in a piece of paper. This, if struck by a hammer, will, under proper conditions, spring into flame. The handling of phosphorus is exceedingly dangerous, so that we hesitate to advise its use. A Doelreiner's lamp, which by the action of dilute sulphuric acid on zinc generates a hydrogen gas, which, if a current be directed on a bit of platinum sponge, produces light, would, we think, be more suitable to your wants.

(76) B. W. S. writes: Several gentlemen and myself have had a dispute on hydraulics relative to the workings of a pump, and have decided to leave the decision to you. These parties claimed to have seen a pump that would work any depth, a hundred feet if necessary, with a cylinder only twenty-five feet from the pump, provided there are valves every twenty feet in the pipe below the cylinder. Now, they admit, according to the teachings of hydraulics, that a pump will not lift theoretically more than thirty-two feet, and practically about twenty-eight, and yet they make that claim and the only explanation they can give is that, as you create a vacuum from one valve to the other, the water from the lower next section will fill that vacuum, and so on down to the last one. A. We have seen the same statement in the papers, but the thing is a fallacy. What is to sustain the column of water, when the valves open? Water can be lifted from no greater depth with, than without these valves; their only effect would be to reduce the shock when the valves close, even if they were made to work by having the supply of sufficient head, or within, say, 20 or 27 feet the height of pump.

(77) A. S. L. asks: 1. What will best cleanse brass chandeliers soiled by flies? A. Oxalic acid and whiting, mixed and applied wet with a brush, and brushed again when dry with a soft plate brush, to polish with dry whiting. 2. What will take the stain from a marble mantel caused by water in which flowers have been standing? A. 2 parts sodium carbonate, 1 of pumice stone, and 1 of finely powdered chalk. Mix into a fine paste with water. Rub this over the marble, and the stains will be removed, then wash with soap and water. 3. What is the best varnish for black straw hats, and how made? A. Best black sealing wax, ¼ ounce; rectified alcohol, 2 ounces; powder the sealing wax, and put it in with the alcohol into a bottle; digest them in a sand bath or near the fire till the wax is dissolved; lay on warm with a fine soft hair brush before the fire or in the sun. 4. Is the earth attracted by a body however large falling through its atmosphere? A. The attraction between any two bodies is directly proportional to the product of their masses, and inversely proportional to the square of their distances asunder.

(78) H. J. M. H. asks if in the slide valve of an engine the lock nuts on the valve rod want to hold the valve perfectly firm, or should there be some play for the valve between the nuts? What is the best work on engineering? A. They should not, yet should not be rigidly tight. Usually leave the nuts so close to the bearings that there shall be no loose play of the valve lug. See "Roper's Engineer's Handy Book," $3.50.

(79) A. M. C. writes: We wish to protect our buildings against fire, by building a reservoir on the hillside, and bring the water down in a pipe to hydrants, etc. At what height shall we have to place the reservoir, and what size pipe shall we have to use to throw a stream of water one inch in diameter, fifty feet high? For efficient service the reservoir should be 100 feet above the ground floor of the building, 4 inch service pipe from reservoir to and through buildings with 2½ inch hose and ¾ inch nozzles, outside hydrants to be well protected from frost, and provided with 2½ hose with ¾ nozzles.

(80) L. R.—We have never heard of a case of resuscitation from drowning after the individual had been hours under water, but can conceive of possible instances of suspended animation, such as has sometimes led to people being buried alive, and that led to the supposition that one had been dead for hours. The longest quoted instance of immersion and subsequent recovery is twenty minutes, and then it was supposed the immersion had not been complete, as from one to two minutes almost always causes death.

(81) A. G. asks (1) the weight of the heaviest locomotives, including tender, in use? A. A "consolidation" of the Atchison, Pacific and Santa Fe Railroad, weighing 115,000 pounds. 2. Would it require greater or less power to draw a wagon over a plane of glass than over a plane of iron or any substance? A. The hardest and most perfect track has the least friction. Glass is too brittle for a track. Steel is the most perfect track in use.

(82) E. C. N. writes: 1. Given two grinding cylinders or rollers, one seven inches diameter and ten inches face, the other ten inches diameter by seven inches face, the shaft of each running at the same speed, do they each require the same power, and each grind the same quantity in the same time? The above to be used for grinding apples. A. At the same speed of shaft the roller of larger diameter requires the most power and does the most work. 2. How can molasses sirup be converted into good vinegar, or can a better use be made of it? The heat of the past season has soured it just enough to render it unfit for ordinary use. A. Vinegar can be made from the sour molasses by adding water and yeast, and exposure to air by leaving out the bungs.

(83) A. D. asks where he can find something more about vaseline or cosmoline. A. The manufacture of vaseline is quite simple. When the lighter liquids, gases, etc., of the petroleum oil have been distilled over, the remaining product, thetar, is placed in a large open iron boiler, which is suspended over a hot fire in the open air until deodorized, when it is filtered through bone black at such a temperature as to keep it in a liquid state. This is all there is to it. Further details must be acquired from practical experience.

(84) T. F. H. writes: Can you give a recipe for dissolving crude rubber, so as to make a paste or cement such as printers and stationers use in making paper tabs? We are using a preparation made by dissolving rubber in bisulphuret of carbon, but we find it objectionable on account of the unpleasant odor arising from the carbon, and want to know in what other way a cement can be prepared? A. Rubber is likewise soluble in benzol, in ether, in naphtha, etc. See also answers to query 2, SCIENTIFIC AMERICAN, July 14, 1883. Common glue with about five per cent glycerine is likewise used.

(85) M. I. writes from Texas: This country for miles is covered with a mineral commonly called lignite, it resembles coal very much, but it is very soft and when laid in the air it crumbles up into very small pieces, and when put in the fire it burns, but seems to give very little heat. It is found in places about 3 or 4 feet below the ground, and is only about 12 inches thick, while in other places it is about 3 feet thick. Is the presence of lignite any indication that there is any stone coal deeper in the ground, and, if so, which would be the cheapest plan of probing for it? A. It is presumed that throughout Texas the geological strata containing coal lie beneath the surface, and from the occasional outcroppings that have been found it is inferred that a very extensive deposit of coal lies throughout the State. The superficial presence of lignite does not, however, suggest the existence of coal beneath. Digging and boring are the only methods of determining its existence.

(86) F. T. D.—Gun barrels to be blued are first thoroughly polished, and then packed in charcoal in a cast iron box which is sealed air tight. The case is then heated till just below red heat, and afterwards gradually cooled.

(87) A. B.—We know of no formula for a gravity grade except the limiting one of least traction as approaching a level, and the point of safety in the application of brakes. The practice covers all angles between a dead level for short distances after a descent, and one to twenty for short grades. The steepest gradient known that is worked with brakes for any distance is a branch to the mines near Leadville, which has grades of over 400 feet to the mile. We recommend you to obtain some standard engineering works.

(88) D. Bros.—Supposing that your compound engine is running at 100 revolutions, and that you have an exhaust pressure of about 5 pounds. Each cylinder is developing about 30 horse power, or 60 horse power for the compound engine. The nominal horse power is supposed to designate the size of an engine at some received standard of pressure and speed, while the indicated horse power is variable according to pressure and speed, and may, in your case, be any horse power from 30 to 80. You cannot pulverize bones in a steam digester to any advantage. A mill is universally used.

(89) H. R. C. asks: 1. Is there enough of assaying to make it profitable as a business? A. There are many persons, especially in the West, whose only source of income is from their assaying. 2. What prices are charged? A. The prices vary according to competition and number of assays. The price in New York is generally $5.00. 3. How long would it require for one conversant with chemical manipulations to learn it, if his whole time were devoted to the study? A. Three to six months. 4. What prices do chemists charge for analyzing substances, such as articles of food, water, etc.? A. From $10.00 upward according to the number of ingredients to be determined. Write to Professor C. F. Chandler, of New York, for his price list. This will give you specific information on this point.

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**AND EACH BEARING THAT DATE.**

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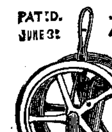

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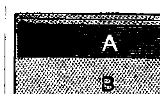

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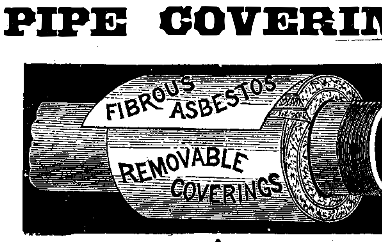



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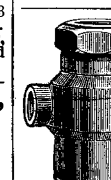

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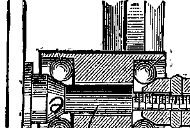

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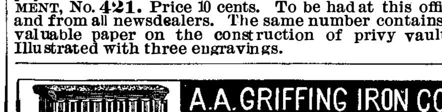

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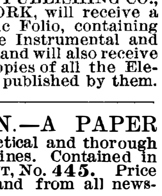



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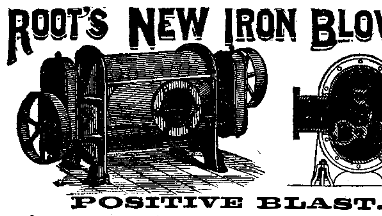

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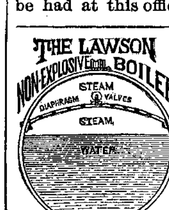



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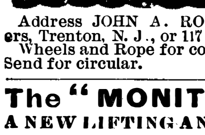

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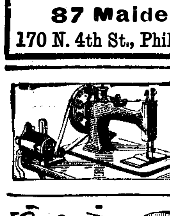

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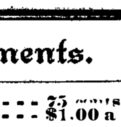

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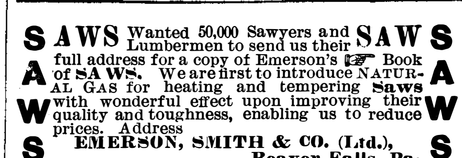

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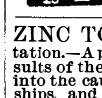

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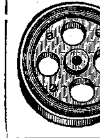

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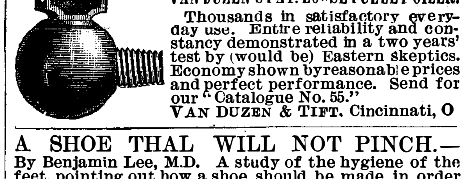

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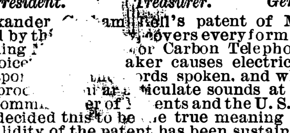

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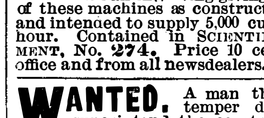

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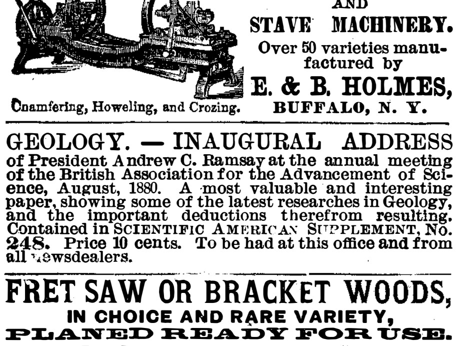


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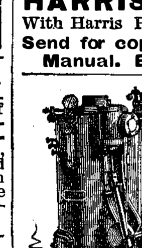

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