

SCIENTIFIC AMERICAN

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SEWAGE UTILIZATION NEAR PARIS.

The sewage of Paris, which formerly wasted directly into the Seine, now flows into a subterranean canal which conducts it to Asnières, about four miles from the city, and there delivers it into the river. The consequence is that, while the water of the latter is little contaminated as it flows through Paris, that which passes the villages below Asnières is black and polluted, and wholly unfit for either domestic or industrial uses. Not merely are the waters rendered impure, but they are heavily charged with solid matter which fills up the channel at the rate, it is estimated, of nearly ten million cubic feet per year, thus obstructing navigation and furnishing a dangerous source of infection during low water. The population along the stream have long protested against this practical confiscation of the river by the capital.

In order to remedy this condition of affairs, two systems have been suggested. One involves the direct utilization of the sewage for agricultural purposes, as it is a valuable fertilizer, and the other its complete disinfection and clarification before diverting it into the Seine. The municipal government, desiring to test both systems, charged two engineers, MM. Mille and Durand Claye, with that duty; and experiments were begun on a small scale in a meadow at Clichy. Trials have subsequently been continued on the plain of Gennevilliers, near the river. The engravings given herewith represent the experimenting field, Fig. 1, and the basins in which the chemical processes of purification are carried on, Fig. 2. From the orifice of the subterranean canal leading to Asnières, the sewage is forced by steam pumps into conduits which cross the Seine under the sidewalk of the Clichy bridge; and thence it flows from this receptacle into a reservoir. The sewage travels in a canal to the experimenting field. The main canal is a little above the general level, so that the material easily flows into the smaller canals, which may be compared to the arteries of the system, and thence to smaller conduits or feeders, analogous to the veins. These feeders mark the boundaries of the various parts where marsh cultivation is carried on. The sewage being thus brought within reach of the gardener, its expenditure is regulated by the latter, simple means being provided whereby the supply may be diminished or shut off from any portion of the area under cultivation, or whereby the entire surface may be flooded.

The surplus water runs into three huge masonry basins, in which sufficient sulphate of aluminum is placed at a time to purify a month's inflow of sewage. The water, thus rendered pure and colorless, is led into the Seine. Every month the basins are strained, the deposit collected, dried, and sold as manure.

Recently attempts have been made to utilize all the sewage of Paris for fertilizing purposes, without diverting any of it into the Seine; and to this end arrangements have been made to distribute the sewage over an immense tract of land near Gennevilliers. This plan, however, so far from benefiting the farmers, has only served to

arouse their strong opposition. The enormous mass of water absorbed by the soil of the experimenting fields has corrupted the underground springs which supplied the wells, caused inundations in cellars, and resulted in the production of infectious and malarial disease. At the same time, it is stated, while the vegetables grown on this sewage-soaked ground are larger and finer in appearance than is usually the case, they are watery, poor-tasting, not nutritious, and do not keep well. As matters now stand, the problem is an open one. Paris cannot continue to pour her sewage into the Seine at Asnières for the reasons already stated; nor can the distribution of the sewage over the adjacent country be carried on without the bad results noted. The consequence is that

excellent opportunity for some one to solve the problem and earn both fame and great reward.

Heat.

Recently, in resuming his lectures at the Royal Institution, Professor Tyndall, having caused a ball of lead to fall from the roof of the theater on to a stone, he drew the ball up again and let it down gently with a string and pulley. The heat generated by the collision in the first instance was the exact equivalent of the heat produced in his finger and thumb and in the string in the second instance. The outlay of muscular force expended in drawing up the ball was made obvious by causing the ball to be drawn up again by a small engine worked by compressed air. The exact equivalent of the heat evolved by a quantity of coal, completely consumed by consumption with oxygen, sufficient to lift a weight of 50 tons to a height of 100 feet above the earth, would be produced by the collision of that mass with the earth when allowed to fall. Given the velocity of a body, the heat generated by the destruction of that velocity could be easily calculated, and some time ago he was led to the conclusion that the stoppage of a rifle bullet would produce sufficient heat to fuse the metal. This conclusion was proved in the Franco-German war, when bullets which had been stopped by contact with a bone showed on being extracted undoubted marks, in many cases, of fusion. The same thing had also been illustrated incidentally in the experiments with gun cotton at Stowmarket. The old notion of heat was that it was a substance which could be

squeezed out of matter as water was squeezed out of a sponge. A bullet squeezed in a hydraulic press acquired heat, rendered obvious in the galvanometer by the thermo-electric pile. Even as late as the time of Faraday it was conceived that heat was something for which some bodies had a greater capacity than others. If compressed air from one vessel were allowed to pass into a vessel in which the pressure was much less, it would then have been said that the motion of the air gave to the comparatively empty vessel a greater capacity for heat. The heat thus produced was shown by

means of the galvanometer and the thermo-electric pile; the reason for that heat was differently understood now. The co-efficient of expansion of gases was next described; and the explanation of different metals, when subjected to the same degree of heat, not possessing in themselves the same amount of heat, was that heat had two operations, one the production of tremors (which were heat), the other the weakening of molecular attraction. Thus, if lead and iron were exposed to the same high temperature, the lead would be much hotter than the iron, because in the former case less internal molecular work was performed, and more heat was expended in the production of tremors; while in the latter case more heat was used up in internal work, and less in the production of tremors. The same degree of heat was in operation, but the apparent results were different.

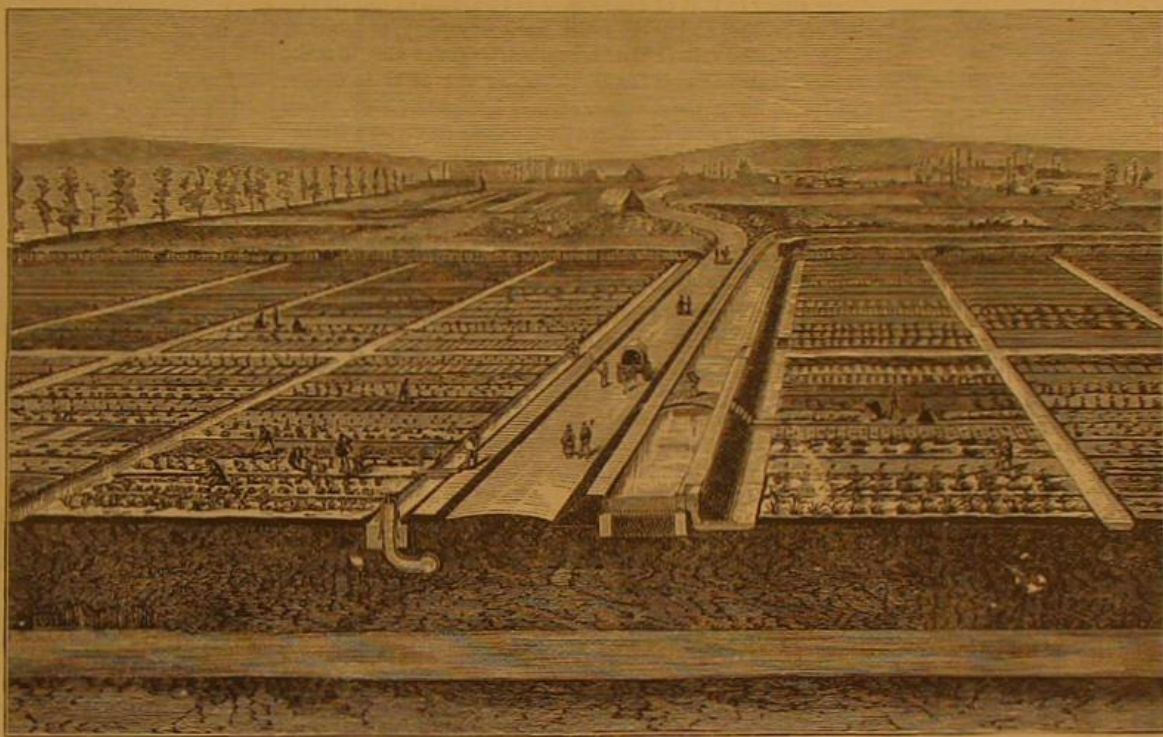


Fig. 1.—SEWAGE-IRRIGATED FARM, GENNEVILLIERS, NEAR PARIS.

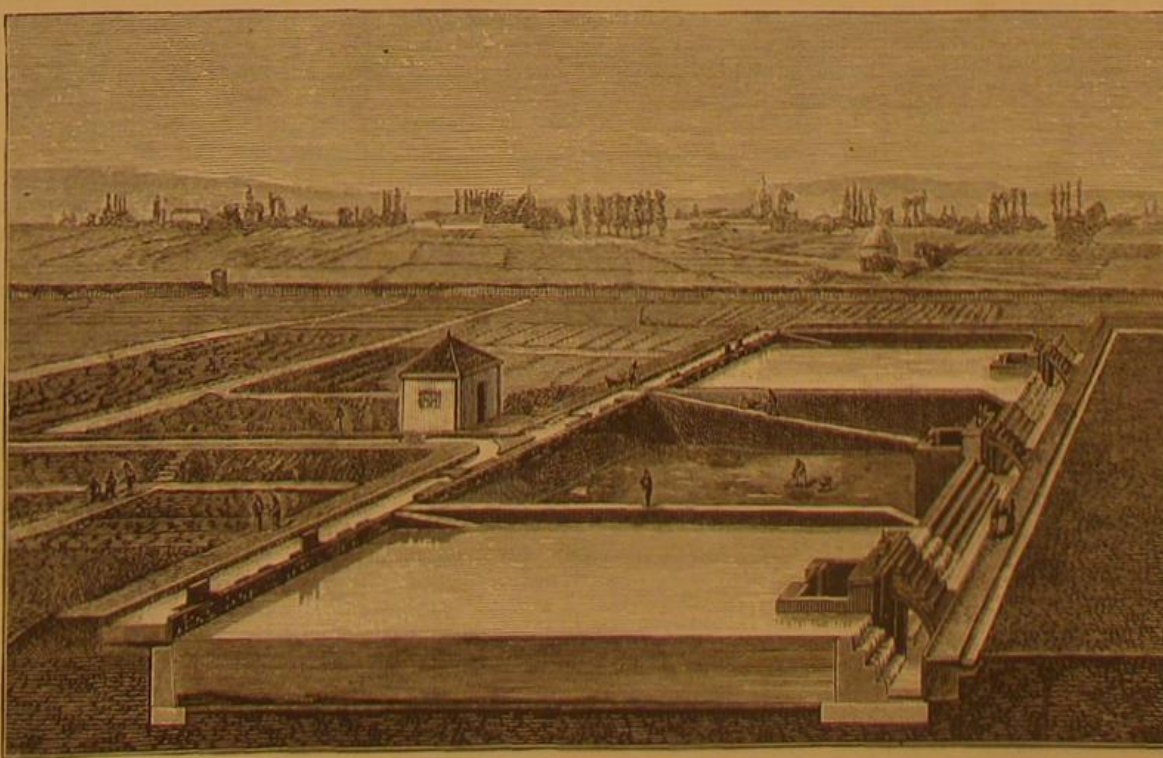


Fig. 2.—SEWAGE-PURIFYING BASINS, GENNEVILLIERS, NEAR PARIS.

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NEW YORK, SATURDAY, JUNE 16, 1877.

Contents.

(Illustrated articles are marked with an asterisk.)

Answers to correspondents.....	373
Babbitt boxes (25).....	373
Boiler, foaming in a (13).....	373
Boilers, scale in (16).....	373
Boilers, strength of (17).....	373
Brass, tin (24).....	373
Business and personal.....	373
Canal, cleaning out a (14, 25).....	373
Cellars, water in (20).....	373
Cotton and corn.....	373
Crops, two great.....	373
Dead sea, the (22).....	373
Eccentrics and slide valves (28).....	373
Electric illumination progress.....	373
Electrical treatment of wounds.....	373
Electricity, felling trees by.....	373
Engines for boats (6).....	373
Engines, proportions of (49).....	373
Furnaces, rust in (19).....	373
Galvanized iron, crystals on (30).....	373
Gastric juice, investigations of.....	373
Gas in vessels (26).....	373
Gauges.....	373
Geological map (29).....	373
Grinding, fast and slow.....	373
Guano deposits, new.....	373
Gunpowder and gun cotton (23).....	373
Harper, Fletcher.....	373
Heat.....	373
Heat, propagation of.....	373
Hemlock knot, to bore a.....	373
Inventions patented in England.....	373
Inventions, value of small.....	373
Ironclad, new Turkish.....	373
Iron, splitting (27).....	373
Leather in Germany, American.....	373
Light, the undulatory theory.....	373
Locust prospects.....	373
Logs in a stream (21).....	373
Lumber, cost of (5).....	373
Measure, liquid.....	373
Mexico, science in.....	373
Mount St. Elias, surveying.....	373
Nebula, what are they.....	373
New books and publications.....	373
Oil, cleaning dirty (12).....	373
Paddle wheel, feathering.....	374
Painting brick walls (7).....	374
Panel wainscoting, equating (1).....	374
Paper hangings, dangerous.....	374
Paper transparent (21).....	374
Patent decisions, recent.....	374
Patent law, new German.....	374
Patents, American and foreign.....	374
Patents, official list of.....	374
Peruvian antiquities.....	374
Photographing machinery.....	374
Photographs, solar (25).....	374
Pipe tools.....	374
Pulleys, dimensions of (30).....	374
Roofs, leaky shingle (3).....	374
Roofs, preserving (22).....	374
Sailing against the wind.....	374
Salt in England.....	374
Scientific American, the.....	374
Scientific American, value of the.....	374
Sewage utilization in Paris.....	374
Shells, dissolving (10).....	374
Shells, varnish, spreading (27).....	374
Shrinkage.....	374
Sidewalks, concrete (9).....	374
Signs, painting (26).....	374
Silver solution tanks (26).....	374
Sparks, zigzag.....	374
Spindle steps, metal for (34).....	374
Spring, shaping.....	374
Statues, of iron.....	374
Steam economy computations.....	374
Sulphate of lime in water (8).....	374
Taps, bright (43).....	374
Taxing power of legislatures.....	374
Telegraphy, quadruplex.....	374
Tramps, utilizing.....	374
Tree, felling, by electricity.....	374
Wagon axles, proportions of (15).....	374
Wagon wheels, size of (16).....	374
Water, impure cistern (4).....	374
Water, sulphate of lime in (5).....	374
Water through orifices (2).....	374
White, Paris, and white lead.....	374
Zinc-lined water coolers.....	374

TABLE OF CONTENTS OF
THE SCIENTIFIC AMERICAN SUPPLEMENT,
No. 76,
For the Week ending June 16, 1877.

I. ENGINEERING AND MECHANICS.—The "Victory" Printing and Folding Press for Newspapers; 2 engravings.—Quantity of Coal required at different establishments to Puddle 1 Ton of Iron. On Axle Breakage, by W. THAMM; giving breakages and causes on nine European Railways; with 2 illustrations.—Remarkable Action of burning Gunpowder on Steel.—Strength of Bricks, with details of tests. Friction, by Professor A. S. KIMBALL; being a New Investigation into one of the Laws of Friction, with 6 tables of co-efficients. A valuable paper. New Gas Pressure Gauge, 1 engraving. Steam Boiler Economy: giving the comparative Economy of various Boilers established by Tests instituted by the Societe Industrielle de Mulhouse, with 11 illustrations, showing the Experimental Boilers with Dimensions. On Heating Feed-water, by J. HAGO, M.E. With rules for calculation of advantages, tables, etc. A practical and useful article. The London "Times" on American Manufactures. The Irwell River Bridge, Manchester, Eng. J. G. LYNDE, Engineer. With 15 illustrations; dimensions and details. On the Ball supported by a Jet of Air, Steam, or Water, by W. F. DURRELL, C.E. Showing several new examples of the "Ball Puzzle," and proving its Antiquity, 10 figures.—Fireproof curtain.
II. TECHNOLOGY.—Wool Dyeing, by GEORGE JARMAIN. An able, valuable, and practical paper, showing the latest best, and most economical processes, including a general statement of the requisites for practical success, the proper water, and how to remove impurities therefrom; Clarke's Soap Test; Logwood as a Reagent for Water Impurities; the Dyeing Test; Influence of Impurities contained in Water on Seizing, Rinsing, and Dyeing; Influence on Mordanting and Dyeing; Impurities in the Form of Iron salts, Alkaline Carbonates, Organic Impurities, Free Acids and salts; how to Purify and Correct Waters that are to be Used in the Treatment of Wool; Exposure to Air, Subsidence, and Filtration; Clarke's Softening Process for Hard Waters; Wanklyn's Method; Treatment of Hard Waters with Soap; Correction of Waters in the Dye Bath; Purification of Refuse Waters from Woolen Mills; Seizing, and Seizing Materials; Wool Seizing; Yarn Seizing; Cloth Seizing; Wool Bleaching; Recipes for Liquid and Gas Bleaching; Tinting or Dyeing White; Testing of Indigo; Utensils; Wood, Madder, Bran, Lime, Indigo; Setting the Wood Vat; Advantages of various Vats.—Recipes for the Yellow Colors, Tan Brown, California, the Drabs, Quercitron Bark, Fustic, Young Fustic, Turmeric, Persian Berries, Sumac, Cochineal, Lac Dye, Sarsaparilla, Eosine, and extracts of Indigo. Adulteration of Cochineal, describing 4 Tests.—Why Silk Hairs are Dear.—Vegetable Coloring Matters.—Tannin.—The Aberdeen Comb Industry.
III. CHEMISTRY.—On Fermentation, by DR. ANDREW P. AITKEN. A concise and clear explanation of the subject.—Silicofungic Acid as a Reagent for Alkaloids.—Zinc in Animals and Vegetables.—Effect of Acids on Vegetable and Animal Fiber.—Siderophyllite.—Wearing Properties of Aluminum.—Preservation of Anthracite.—Proceedings of the Academy of Sciences, Vienna, with brief notices of a large number of interesting subjects presented by distinguished members.
IV. NATURAL HISTORY, GEOLOGY, ETC.—Evidence of the Age of Ice, by HENRY WOODWARD, F.R.S. With 5 engravings. An interesting and important paper. The Joyful Tree of Mexico, by Professor ALFONSO HERRERA. Temperature of Sea, by DR. W. B. CARPENTER.—Xanthium Spinosum, the Hydrophobic Cure.—Bacteria, and what will kill them.—Geological Time, by T. MCLAND READE.—Colored Hail and Snow, by DR. A. T. MACHATTE, F.C.S., etc.—How the Earth may be destroyed.

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PROGRESS OF ELECTRIC ILLUMINATION.

In describing the Jablochhoff electric candle, recently, we noted the fact that the inventor was engaged on further experiments, and that new discoveries would doubtless soon be forthcoming. M. Jablochhoff now announces that he has succeeded in dispensing with the carbons of his candle altogether, and derives the light from the insulating material alone—a proceeding somewhat analogous to throwing aside the candle and igniting the candlestick. In fact, we cannot see that the inventor has left anything of the original electric lamp at all. He began, a few months ago, by abolishing all the elaborate regulating mechanism, and produced simply a pair of carbon rods, placed parallel, separated by an insulating partition of clay and held in a metal casing. This was made the subject of experiments by a War Office Committee of Royal Engineers, at Chatham, England, where the apparatus was demonstrated to give 50 per cent greater power of light than had ever before been obtained from any electric light.

Not contented, however, with this showing, M. Jablochhoff proceeded to denude his candle of its outer casing, leaving merely a double carbon wick with a strip of the insulating compound between the carbon points, which terminated at the bottom in metallic tubes as before. It was this form which we recently illustrated; and with this, M. Jablochhoff succeeded in arranging means for dividing the current, so that, instead of one very powerful light, he had eight from one and the same circuit. Six of these lights illuminated Marengo Hall in the Louvre, Paris, with a brilliancy equal to that of 100 argand gas burners of the largest size. The East and West India Dock Company, of London, recognizing the value of the invention, began at once to make arrangements to use it for illuminating one of their docks; and hardly have these arrangements been completed, when M. Jablochhoff now discovers that he can dispense with the carbon points altogether, and obtain the required light by passing the electric current through the insulating material itself, which is simply kaolin clay. It seems that, while experimenting with sparks from a current of great tension, the inventor passed them through a plate of kaolin, placed between the two ends of the wires from a couple of coils in which the current was induced by a magneto-electric machine. He then found that, although the current was unable to fuse the kaolin, it did heat it to incandescence. By priming the kaolin plate with a better conductor, he then succeeded in obtaining a very brilliant light with a very small consumption of kaolin, so small, indeed, that a kaolin plate barely half an inch in length is sufficient for a small light burning ten hours. A band of kaolin may be made to give a magnificent light; and as, practically, any desired number of coils can be placed on the circuit of the magneto-electric machine, and each coil can be made to produce an electric light, the divisibility of the light appears to be all that can be desired. In fact, the inventors—for M. Denayrouze is associated with M. Jablochhoff—have produced a series of electric lights of intensities varying from the equivalent of two gas jets to as many as fifteen. What is more, any one of these lights may be turned out, or the whole illuminating power of the current diverted into one burner.

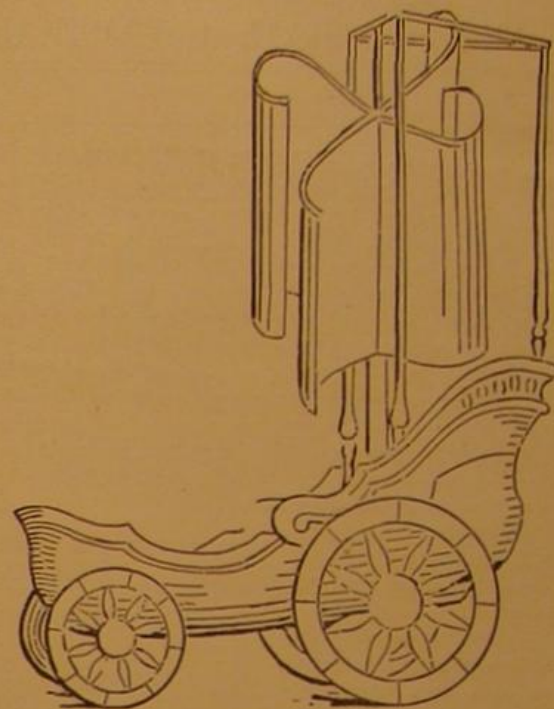
The inventors state that they have used bands of kaolin longer than the induction spark which the coil is capable of making, and that the intensity of the light, which is soft and uniform, depends on the number of spirals and diameter of the wires used in the coil. By using fifty coils, M. Jablochhoff says, it is easy to obtain as many lights of variable intensity. He has arranged coils so as to give a series of gradually increasing lights, ranging, as before noted, from two to fifteen gas burners in power. By using alternating currents the interrupter and condenser of the induction coils are dispensed with. The total system of distribution of currents is then reduced to a central artery represented by the series of interior wires of the coil, branching from which are as many distinct conductors as coils are placed in the circuit. It is proposed to employ the carbons arranged as previously described where an intense light is desired, and to adapt the kaolin light to the ordinary illumination of streets and buildings.

This is electric illumination *minus* voltaic arc, regulators and carbons, in fact, *minus* everything except the electrical generator, wires, and kaolin. M. Jablochhoff is still at work, and promises even further improvements.

SAILING AGAINST THE WIND.

Wendell Phillips, in his famous lecture on the "Lost Arts," used to delight in trying to convince his hearers that the ancients were more ingenious than the inventors of the present day; and it is well known that rude copies of some of our most noted devices have been discovered among the relics of past ages. Hence, without denying the possibility of there being anything new under the sun, we may naturally hesitate to believe that every so-called new invention had no counterpart in former times. An instance of a singular coincidence in the views of two inventors, at an interval of nearly two centuries, may be of interest. John Wilkins, Lord Bishop of Chester, and Member of the Royal Society, was equally celebrated as a philosopher and as a divine; and his writings on scientific subjects contain much interesting and valuable information. His treatise on "Mathematical Magick," first published in 1648, has a chapter entitled: "Of a Sailing Chariot, that may without Horses be driven on the Land by the Wind, as ships are on the Sea." In this, the writer speaks of the sailing chariots which were used by the ancients, and after describing their

construction, goes on to say: "I have often thought that it would be worth the experiment to enquire whether or no such a Sailing Chariot might not be more conveniently framed with movable Sails, whose Force may be imprest from their Motion, equivalent to those in a Wind-mill. Their foremost Wheels (as in other Chariots) for the greater Facility, being somewhat lower than the other, answerable to this Figure, in which the Sails are so Contrived, that the



Wind from any Coast will have a Force upon them to turn them about; and the Motion of these Sails must needs turn the Wheels, and consequently carry on the Chariot itself to any Place (though fully against the Wind) whither it shall be directed. The chief doubt will be, whether in such a Contrivance, every little Ruggedness or Unevenness of the Ground, will not cause such a jolting of the Chariot, as to hinder the Motion of its Sails. But this perhaps (if it should prove so) is capable of several Remedies. I have often wondered, why none of our Gentry who live near great Plains, and smooth Champions, have attempted anything to this Purpose. The Experiments of this kind being very pleasant, and not costly: What could be more delightful, or better Husbandry, than to make use of the Wind (which costs nothing, and eats nothing,) instead of Horses? This being very easy to be effected by those, the Convenience of whose Habitations doth accommodate them for such Experiments."

Now comes the proprietor of the "Universal Wind Power," with a patent granted last year, for a carriage propelled by a windmill, which, he says, "runs readily against the wind as well as in any other direction." He has gone further than Bishop Wilkins, for he has built a machine which has satisfactorily demonstrated its ability to do what is claimed for it; and now the inventor offers it for use in localities where there is plenty of surplus wind. On prairies and the sea coast, it is not improbable that this machine would prove very useful. Doubtless the proprietor of the "Universal Wind Power" believes that he is the original inventor of the device; but it may well be doubted whether he can hold the patent right to the use of the invention as a whole—that is, to the application of a windmill to a vehicle.

PASSAGE OF THE NEW GERMAN PATENT LAW.

We announce with much pleasure the promulgation of the new patent law for the German Empire, to take effect on and after July 1 next. This new law, although it is not quite up to the progressive ideas of our countrymen, is nevertheless a great improvement on the previous system, and opens to American inventors an additional market, of large extent, for their new ideas.

Heretofore it has been necessary in order to patent an invention in Germany to take separate patents in each separate State, of which there are twenty-one. Thus twenty-one sets of drawings and specifications were necessary, for each of which an agent must be employed and special fees paid. The total expense was so great that few patents were ever taken; the applications being confined to the larger States, foremost among which was Prussia. But here, unfortunately, was in vogue a stringent and narrow-minded system of official preliminary examination, resembling that which prevailed in this country twenty or thirty years ago. Under this Prussian system, patents for the most valuable improvements were rejected. Thus a patent for the Howe sewing machine could not be allowed in Prussia because it was not considered by the Prussian patent office examiners to be an original invention, but merely an improvement on some former attempt to sew by mechanism. A patent for the celebrated American invention of Broadwell, for gas-check rings for breechloading cannons, was refused in Prussia on similar grounds; but the Prussian Government copied Broadwell's plan and introduced the invention into its army and naval service, without allowing him any compensation. The celebrated German guns of Krupp are provided with Broadwell's invention, without payment to the inventor; although, with-

out the invention, Krupp's guns could not be successfully used. All of these objections are removed by the new law, which permits the patenting of improvements of all kinds except medicines and foods, as articles; but the processes of producing such articles can be patented.

The duration of the new patent is 15 years. It extends over the entire German Empire, comprising twenty-one States, and embracing an aggregate population of about fifty millions, more or less.

Every patent is to be granted subject to the payment of an annual tax: subject also to a commencement of the working of the invention within the limits of the empire, within three years from the date of the patent.

These are some of the principal provisions of the new German patent law, concerning which we shall from time to time give our readers additional information.

In the meantime we would give notice to the many patrons of the Scientific American Patent Agency that Messrs. Munn & Co. have already completed their arrangements for taking patents in the German Empire under the new law, and are now ready to receive and give prompt attention to all applications. The proceedings are simple, and the costs light; the expenses, including the first year's taxes, amount only to one hundred dollars. Circulars of information, with particulars about the new German law and the patent laws of other foreign countries, England, France, Belgium, Austria, Italy, Spain, Russia, etc., may be had gratis at this office.

TAXING POWER OF THE LEGISLATURE.

In our issue of July 18, 1874 (page 32, volume XXXI), an article appeared quoting a portion of a then recent opinion of the court of last resort of the State of New Jersey, at the suit of "The Mayor, etc., of Newark vs. Agens et al.," which held in substance that the power of the legislature to tax or assess property, along the line of and for local street improvements, was limited to the special benefit which the property derived from such improvements. This position was contrasted with the nearly opposite view of the Court of Appeals of the State of New York, whose decisions have gone further perhaps than those of any other State in the Union, in holding that the power of the legislature was supreme in all matters of taxation, or, in other words, that "man was made for the State and not the State for man." The practical operation of this rule has been that, in many of our large cities, streets and boulevards have been built through pastures and swamps, under these legislative acts, without the wish or consent of a majority of owners; and the vast cost, with high prices and great frauds added thereto, has in many cases confiscated the property and ruined the owners; and the latter, under the decisions of our courts, have been without remedy.

That such a state of affairs should exist under a government not omnipotent, but where the people are supposed to rule, has led to much serious thought and discussion. It seems to have been considered by our courts quite fully, in the suit of Weisner vs. Village of Douglas—just reported in 64 N. Y. Reports, page 91—opinion by Judge Folger.

While this case turns upon the question of the constitutionality of the legislative act which authorized the village to issue bonds, to raise money, to pay for stock subscribed for, and collect by taxation to pay the bonds, yet the court, in its able opinion, holding the act unconstitutional, lays down a broad doctrine of equity, which, if applied, will relieve the people from many wrongs and much legalized robbery, even if it does not check reckless legislation. Honest taxpayers have long suffered from oppressive legislative acts; and whatever the future may disclose, they have seemed in the past to have no proper remedy in the courts.

ZINC-LINED WATER COOLERS.

Several correspondents have lately written to us concerning zinc-lined water coolers, complaining of the disagreeable flavor which the zinc imparts to water from melted ice. Several weeks ago, we had occasion to note the deleterious effects of water that had passed through zinc-coated or galvanized iron pipes. It is obvious that what was there said equally applies to zinc or galvanized iron-lined water reservoirs of any kind, although we admit that the corrosive action of any fluid is greatly diminished by a reduction in temperature. We think there can be no manner of doubt that the use of zinc or galvanized iron for such purposes is highly objectionable. The general action of zinc salts on the animal system is to cause persistent diarrhoea; and in conjunction with the enervating effects of hot weather and other causes tending in the same direction, this may result in very serious consequences—more especially with young children and persons suffering under the infirmities of age. During the next few months, these ice water fountains will receive marked attention, so also will cholera mixtures. If our readers would avoid headache and nausea, let them banish these "crystallized" coolers. The best lining for such vessels is, perhaps, porcelain enameled iron; but, unfortunately, there is always a doubt as to the amount of soluble lead the enamel may contain. We have seen some of these enamel-lined coolers in the market; but as they cost nearly twice as much as an ordinary cooler, their sale is very limited, while the handsome galvanized iron ones are found nearly everywhere. Tinned plate has been found unsuitable as a lining material, as the tin soon wears off and exposes the iron. Iron discolors and imparts a disagreeable styptic taste to the water. Glass, porcelain in general, and stoneware or pottery, if free from lead glazes, may be used.

Sawdust is often used in lining the walls of water coolers; but charcoal, in moderately fine powder, is much superior. Care should be taken, in filling the vessels with water, not to wet the lining, as when wet it becomes almost useless. Ice water—that is, water from melted ice—is not conducive to health; but it becomes more pernicious when its reservoir has been a zinc-lined vessel.

QUADRUPLIX TELEGRAPHY.

"We are not aware," says the editor of the *London Telegraphic Journal*, "that a quadruplex circuit exists in England at present, although we are assured that since 1874 quadruplex telegraphy has been an established fact in America, and that its employment there has been eminently successful. Statistics are nevertheless wanting to establish its practical value."

"We seem to be still as much in the dark as ever to the real advantages of quadruplex telegraphy. Without entering at all minutely into the system, it is sufficient to state that the difficulties inherent to the adoption of quadruplex telegraphy are greater than at first sight would be imagined."

"Working a quadruplex system—that is, four circuits upon one wire—to meet the requirements of busy centers of commerce, looks very much like intrusting too many of the eggs to one basket, and in the event of interruptions could not fail to be attended with the most serious inconvenience."

For the information of our valued British cotemporary, we would state, by way of statistics, that the Western Union Telegraph Company is now regularly operating, daily, by the quadruplex system, about twenty thousand miles of its wires. The lines between New York and all the large cities, as Boston, Philadelphia, Pittsburgh, Chicago, St. Louis, Washington, New Orleans, are worked by the quadruplex plan.

For the illumination of our cotemporary, we would state that the real advantage of quadruplex telegraphy is that it permits the sending of four messages over one wire during the time heretofore required for sending one message by the old method. In other words, as much business may be done over one wire, by the quadruplex, as can be done over four wires by the common plan.

There are no inherent difficulties about the adoption of the new system in England. All that is needed is to send over to New York a postal money order and pay for as many instruments as are wanted, and then set them to work. They will work just as well in London as here.

To stand in the gallery of the great operating room of the Western Union Company, in this city, and gaze upon the multitude of operators there daily at work with the quadruplex instruments, does indeed seem like looking upon a good many eggs in one basket; but we hear of no inconvenience or interruptions therefrom resulting. On the contrary, so great is the regularity and necessity for the new system that the business of the Western Union could not now be transacted except for the quadruplex, the use of which is being rapidly extended. Finally, we suggest to our cotemporary that he make a summer excursion over here and learn something about modern telegraphy. The absence of the quadruplex in England shows conclusively that his countrymen are several telegraphic generations behind the age.

LOCUST PROSPECTS.

BY PROFESSOR C. V. RILEY.

Before spring opened, the most gloomy forebodings prevailed throughout the so-called Western States as to the prospective injury from the Rocky Mountain locust. Nor were those forebodings without foundation. Eggs were laid last fall over an immense stretch of country, from the 94th to the 98th meridian, and in some cases reaching into the mountains, and from near the British American line to the Gulf of Mexico. They remained for the most part sound throughout the winter; and notwithstanding that those which prematurely hatched, or were destroyed by the many different animals that feed upon them, more than sufficient remained as the ground thawed out to give birth to locusts enough to ruin most crops. The young insects began to hatch whenever the weather was favorable, often in such quantities as to daunt the most hopeful: they were graphically described as "boiling out of the ground," and they began to mow down the more succulent plants and to do great injury to young wheat. In some sections, the farmer was prepared and determined to make a fight; and wherever the war was waged with spirit, brains, and concerted action, the foe was vanquished. Yet in many, if not most, instances, he would have given up in despair, had not Dame Nature come to his aid with various most efficient allies. The insects soon began to disappear and to lose their voracious appetites, and at the present time there is, in most of the threatened country, no longer serious alarm, but, on the contrary, every prospect for more than average crops.

Having recently returned from an extended tour of investigation in Texas and Kansas, I take the liberty of quoting from a letter written on the 10th of May and addressed by me to the Governor of the latter State, that portion which bears more particularly on the disappearance of the young locusts:

"In every part of the State I have visited, and where I have examined carefully the condition of things, the young locusts have very largely—in some instances totally—disappeared; and I now have no doubt whatever that the reports of such disappearance are so general throughout the entire portion of the State that was threatened have their foundation in fact. This disappearance is generally attributed to death and dissolution from the cold and wet weather that followed the principal hatching. That

this weather has been largely instrumental in causing death among the hopping pests I have no doubt, because there are always a certain portion just hatched or just molting, which are particularly tender and susceptible to the injurious effects of cold, drenching rains. But they have been yingd and are now dying fast during the present warm and sunny weather, and these dead insects are not parasitized, but simply diseased—sick. In my last (9th) report made to the State of Missouri, in stating the causes that might diminish the prospective injury, I wrote:

"We may therefore expect that, as compared with 1875, a larger proportion of the young that will hatch in 1877 will be weakly and will soon perish." * * * There is a bare possibility that, after the bulk of the young have hatched, and before they have commenced to do serious harm, we may have such unseasonably cold and wet weather as to kill them by myriads, and effectually weaken their power for injury."

Both possibilities have become actualities. It is a singular fact, however, that, notwithstanding the large numbers which hatched, no one has been able to discover the dead carcasses of these disappearing locusts in anything like the numbers necessary to account for the disappearance; and in most instances where dead insects have been reported to me, an examination at once showed that the parties had mistaken therefor the exuviae or empty skins of those which had molted; which skins are always abundant under straw or weeds, or at the base of a wheat stool, where the young insects congregate when undergoing their molts.

The young locusts possess remarkable tenacity of life; and the fact that the bulk of those remaining are in the third stage (that is, have molted twice) and must have hatched before the unfavorable weather set in, is in itself enough to show that other factors than those meteorological have entered largely into the problem of disappearance. The principal of these I will briefly enumerate, because, unlike meteorological or climatic influences, they may, most of them, be relied upon in future, are largely within man's control, and may even be rendered still more effective. They are, in short, elements of certainty in the problems of locust destruction:

First—The natural enemies of the locust. These consist in the present instance (the parasites not affecting it till it gets older) of the vertebrate animals which are known to feed upon it, such as snakes, gophers, field mice, etc., and birds. These last have been more efficient than most of us imagine, and I never saw blackbirds, plover, the Lapland longspur, etc., so numerous. The dung often whitens the fields where the locusts were once thick, and they have been the principal cause of the latter's disappearance. The prolonged cold and wet retarded the development of the insects, benefited the wheat, and gave our feathered friends an excellent opportunity to check them. We should employ all means to encourage the multiplication of the birds.

Second—The farmers. In most parts of the State I have traversed, the farmers had determined from the beginning to make war, and they did make war, and so successfully that the insects were pretty effectually destroyed before the cold and wet occurred. The means employed were mostly kerosene pans and burning—over 700 kerosene pans having been made at Salina alone.

Third—The weather. The continued cold, after the principal hatching, had the effect, as already stated, to kill many that were just hatching or molting. The heavy rains also washed many away into the streams; and in some instances, on soils which contain sand and lime, and which are liable to crack when dry, the rains doubtless covered up and killed such as were sheltering in such fissures.

Fourth—Climate. The fact that the insects, especially after the second and third moltings, are dying, is simply confirmatory of the views I have always held and advanced, that the species is out of its natural habitat, and can never permanently thrive here. These views I need not repeat at length here. While the number that have become sickly and died have not so far begun to compare with those which have perished in the other three ways mentioned, it will doubtless continue to increase as the insects get larger, for already they show a tendency to unnaturally group together during the heat of the day, and feed much less ravenously than when in perfect health."

It affords me pleasure to be able to state that the favorable condition of things reported in the above-quoted passage is not confined to Kansas, but is general. In parts of Minnesota, where the eggs were so thick that to dig the ground when at all moist was to make a paste, the little red mite (*trombidium sericeum*) has swarmed and destroyed them. In other places birds have pecked the ground full of holes in their search for eggs; and from Iowa, Nebraska, and Colorado, the reports are almost unanimous that the young insects that continue to hatch also continue to perish.

A survey of the field at this writing gives every assurance of good harvests throughout the threatened country. They are needed! With ruined crops this year, following so closely the injury of the past few years, many a farmer would have been bankrupt, and the whole country would have seriously suffered. The sickness of the locusts as compared with those of 1875 is a most encouraging sign. Comparatively few will live to get wings. Those that became fledged in Texas are passing northwest in scattering and insignificant flights. The Saskatchewan plains and the northwestern hatching grounds were pretty well depleted last year; and there is every reason to hope for freedom from any general and disastrous invasion for some years to come. St. Louis, Mo.

Sideraphthite.

Sideraphthite is the name given to a new alloy composed of 66 parts of iron, 23 of nickel, 4 of tungsten, 5 of aluminum, and 5 of copper. It is said to resist sulphuretted hydrogen and the vegetable acids, and to be but slightly attacked by mineral acids. It is really more useful than silver, and can be prepared at less cost than German silver.

In our notice of Mr. D. L. Holden's patent for an ice machine, published on page 330 of our issue dated May 26, we gave his address as "Carrington, Ky." It should be "Covington, Ky."

NEW TURKISH IRONCLAD.

Our engraving represents one of the two largest ironclads now possessed by Turkey, the vessels being sister ships in every particular. The present craft was originally called the *Memdonhiyeh*, but has recently been re-named as above in honor of the present Sultan Abdul Hamid. The *Hamidieh* was designed by Ahmed Pasha, chief naval constructor of the Turkish Government, and was built at the Thames Iron Works, London, England. Her dimensions are: Length, 332 feet; breadth, 59 feet; depth, 19 feet; displacement, nearly 9,000 tons. The hull is divided into 71 watertight compartments. A belt of armor plating 12 inches thick, backed by the same thickness of teak, surrounds the vessel. The maindeck battery has plates of similar thickness, and is 148 feet in length, containing twelve 18 ton guns. Four corner ports are so placed at an angle that their guns may be fired astern or ahead. The upper deck armament consists in two 6½ ton guns.

The engines, built by Maudslay, Sons, & Field, are of the usual type peculiar to that firm. There are two piston rods to each cylinder connected by an inclined crosshead, one rod passing over, the other below, the crank shaft. The two steam cylinders are each 116 inches in diameter, with strokes of 4 feet. The screw is 23 feet in diameter, with 19½ feet pitch. There are eight boilers, with 22,500 feet of heating surface. Tests of this vessel on the measured mile gave: Revolutions, 66.3; vacuum, 26½; boiler pressure, 28½ lbs.; speed, 13.74 knots. The ship at last accounts was in England, but is expected to go into active service on the Black Sea.

Investigations on the Gastric Juice.

M. Richet, according to the *Répertoire de Pharmacie*, has been enabled to institute a series of experiments on this subject under singularly favorable circumstances. A young man came before him on whom, in consequence of incurable stricture of the œsophagus, gastrostomy had been performed, and a permanent gastric fistula had been established. The œsophageal stricture being complete, swallowing was of course impossible, so M. Richet was enabled to procure the gastric juice without any admixture of saliva. He finds the average proportion of hydrochloric acid to amount to 0.17 per cent, the proportion being increased by wine and alcohol, but diminished by sugar. The ingestion of acids or alkalis made little difference, as the normal proportion was soon restored. The acidity of the gastric juice is increased during the process of digestion, especially towards its close. The sensations of hunger and thirst are in no way associated either with gastric acidity or with the state of the stomach as to emptiness or repletion. Ordinary kinds of food occupy three to four hours in digestion; but milk takes only half this time, while all traces of water or alcohol disappear from the stomach in about three quarters of an hour. M. Richet has availed himself of this favorable opportunity for the purpose of investigating the nature of the free acid in the stomach, and hopes shortly to publish his researches on this subject.

The Nebulae—What are They?

Mr. E. J. Stone, M.A., F.R.S., Her Majesty's Astronomer, Cape of Good Hope, says, in a paper recently read before the Royal Society:

"Before the announcement of Mr. Huggins' discovery of the presence of bright lines in the spectra of nebulae, it was generally, if not universally, accepted as a fact that nebulae were merely stellar clusters irresolvable on account of their great distances from us. This view had become impressed on the minds of many of our greatest observing astronomers in the progress of their work, and is one therefore which

should not lightly be abandoned. It appears to me that Mr. Huggins' observations instead of being inconsistent with the view formerly held by astronomers, are rather confirmatory of the correctness of that view.

"The sun is known to be surrounded by a gaseous envelope of very considerable extent. Similar envelopes must surround the stars generally. Conceive a close stellar cluster. Each star, if isolated, would be surrounded by its own gaseous envelope. These gaseous envelopes might, in the case of a cluster, form over the whole, or a part of the cluster, a continuous mass of gas. So long as such a cluster was within a certain distance from us the light from the stellar masses would predominate over that of the gaseous envelopes. The spectrum would therefore be an ordinary stellar spectrum. Suppose such a cluster to be removed further and further from us, the light from each star would be diminished in the proportion of the inverse square of the distance; but such would not be the case with the light from the enveloping sur-

such a nebula might be expected to be small. These changes would depend chiefly upon changes in the distribution of the stellar masses constituting the cluster. It has always appeared to me difficult to realize the conditions under which isolated irregular masses of gas, presenting to us sharp angular points, could exist uncontrolled by any central gravitational mass without showing larger changes in form than appear to have been the case with many of the nebulae. In my view of the nature of nebulae this difficulty no longer exists."—*Nature*.

Cutting Down Trees by Electricity.

A few years ago, a Dr. Robinson, of New York city, took out a patent through the Agency of the SCIENTIFIC AMERICAN, for felling trees by means of a platinum wire, in place of the axe or saw, using an electric battery for the severing power, by keeping the wire at a white heat and drawing it back and forth, and keeping it taut to the tree as it penetrated the trunk. We published an account of the invention at the time the patent issued, which elicited considerable attention from all parts of the world. According to the *Lumberman*, an experiment with the same invention has recently been tried in the East Indies, from which our contemporary quotes from a local paper, published in that country. The paper states that the patentees of the process are Mr. H. H. S. Parkinson and Mr. W. H. Martin, both of Bombay; and the experiment was superintended by Dr. Lyons. The plan is simple. The two ends of the copper wires of a galvanic battery are connected with platinum wire, which of course instantly becomes red hot, and while in that state it is gently sawed across the trunk of the tree to be felled. When arrangements were made for the experiment, it was never for a moment doubted that the enterprising merchants of Bombay were possessed of all its made thicknesses of platinum wire, but it turned out that the thickness of the thickest that could be got was only that of crocheting cotton. It was at once seen that a wire of such thinness would be consumed before the tree was half severed from its trunk. However, the attempt was made. The burning wire performed its task very well so long as it lasted, but, as anticipated, the wire continually broke, and at length there was none left. There can be little doubt that with a stronger battery—the one used was only a twelve-chambered one—and a thicker wire, the experiment would have been entirely successful. As it was, the tree was

sawed one fifth through. It is calculated that, under proper conditions, a tree, which at present takes two hours to fell, will come to the ground by this process in fifteen minutes. It is almost needless to add that there is no waste of wood and no sawdust.

Propagation of Heat.

We learn from the *Répertoire de Pharmacie* that M. Olivier has found that under certain circumstances heat is not propagated by direct proximity. His experiment was thus conducted: A bar of steel of certain dimensions being selected, the operator places one hand over the center of the bar and the other over one of the extremities. The other extremity is then heated by rapid friction with energy. At the end of a few minutes the further extremity of the bar becomes so hot as to compel the operator to remove his hand, while his other hand, which had been placed over the middle of the bar (and, consequently, nearer to the extremity warmed by friction), perceives no heat whatever.

To BORE a hole easily through a hemlock knot, wet your auger in turpentine.

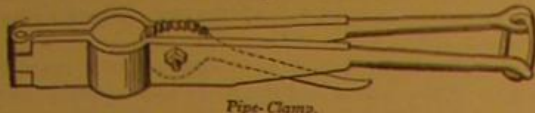


THE TURKISH IRONCLAD HAMIDIEH.

PIPE TOOLS.

The implements represented in the annexed engravings (from Knight's "Mechanical Dictionary,"*) all relate to the manipulation of pipe. Fig. 1 is a pipe holder having a simple

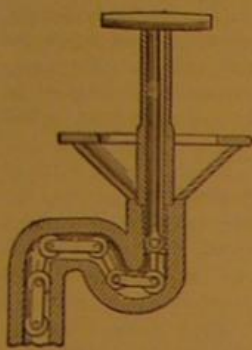
Fig. 1.



Pipe-Clamp.

corrugated cam clamp, whereby the work is tightly held. Fig. 2 is an implement for pushing obstructions out of bends

Fig. 2.

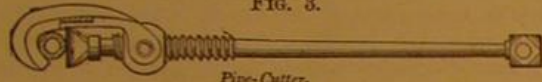


Pipe-Clearer.

in pipe. A force pump is usually employed for this purpose; but, in some cases, a jointed thrusting implement, such as that illustrated, becomes necessary.

Fig. 3 represents a pipe cutter in which a movable jaw is hinged to a nut which traverses the threaded shank, and operates in opposition, either to the socket end of the shank or to a cutter inserted therein. Figs. 4, 5, and 6 illustrate three other forms of this implement. Fig. 4 is a tool with three revolving cutters, so set that two cutters are in the body of the tool, and one adjustable cutter is held by a movable wrought iron

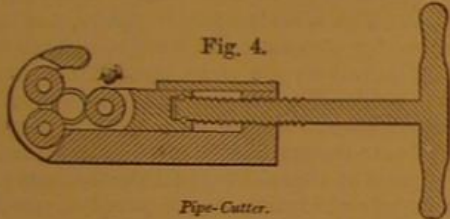
Fig. 3.



Pipe-Cutter.

stock. Fig. 5 represents a tool in which a sharpened disk within a block is fastened to the end of the screw rod; and

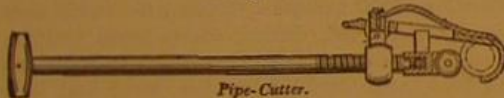
Fig. 4.



Pipe-Cutter.

the pipe, being clamped between the disk and the hook, is cut by turning the instrument around the pipe. In

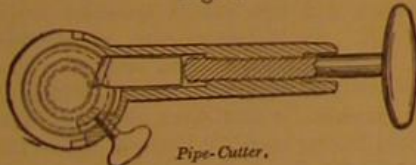
Fig. 5.



Pipe-Cutter.

Fig. 6 the tube and its bushing are made to encircle the pipe; and the cutter is forced into the side of the pipe by

Fig. 6.



Pipe-Cutter.

turning the screw. The pipe is then severed by turning the instrument around upon it.

Fig. 7 is a tool which is let down into a well pipe in order to hoist the latter to the surface. It consists simply of wedges on the head of the draw rod, which are expanded and caused to grasp the tube after being inserted to the proper depth. Fig. 8 is an apparatus for proving steam or water pipes by hydraulic pressure. It consists of a metallic bed plate (on which are fixed two cast iron head stocks connected by strong wrought iron bolts), a cast iron follower with square thread screw, and a hand regulating wheel, screw water valve, and air cock; also a gun metal pressure pump, inclosed in an iron cistern, and a pressure gauge. The method of using the apparatus is as follows: The pipe is placed between the head stocks in contact with rubber rings, and the joints are made by screwing up the follower by means of the hand wheel. The pipe is rapidly

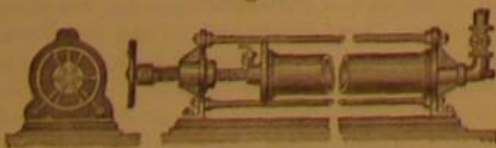
Fig. 7.



Pipe-Grab.

filled with water from any convenient source above the machine by opening the water valve, when the proof pressure may be applied by the pump.

Fig. 8.

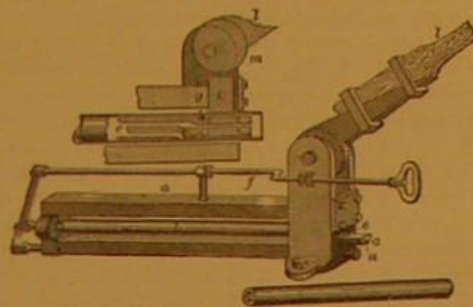


Pipe-Prover.

When cutting pipe, the tool post with the cutter has auto-

matic feed, cutting the ends of the pipe squarely and smoothly. Fig. 9 is a machine for punching holes or slots in metallic tubes, consisting of a frame, *a*, in which is fixed a strong hollow mandrel, *b*. A semicircular wedge, *c*, is fitted into the mandrel and connected by a rod, *e*, to a lever at the other end of the machine operated by the rod, *f*. The frame, mandrel, and wedge are slotted at *g h i*, forming a series of openings through which the punch, *k*, may work. In using the apparatus, the pipe is slipped over the mandrel, and by forcing the rod, *f*, inward, the wedge, *c*, is caused to enter the pipe and resist its tendency to be bulged inwardly under the action of the punch. The lever, *l*, is depressed, operating the eccentric, *m*, and forcing the punch through the

Fig. 9.

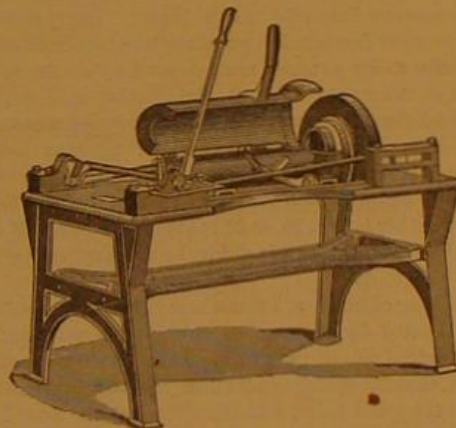


Bridgen's Pipe-Slotting Punch.

upper side of the pipe: the piece of metal cut out is driven through the aperture, *h*, in *i*. An upward movement of the lever, *l*, permits a spring to lift the punch, and the rod, *f*, is pushed inward to withdraw the wedge, after which the pipe may be removed. By a reverse movement of the rod, a small projecting pin on the frame, *a*, is caused to push the chip cut from the pipe out through the longitudinal slot, *n*, in the wedge.

In Fig. 10 is represented a machine for finishing the moulding process of clay or concrete pipes by making a socket on one end to receive the smaller end of an adjacent pipe when laid; *a* shows the pipe before socketing; *b* after-

Fig. 10.



Pipe-Socketing Machine.

wards. The pipe, *a*, is placed in the bed of the machine, and the upper clamp brought down and locked. The head-piece, which has the counterpart form of the socket, is then brought forward by the lever, expanding the clay into the shape of the former.

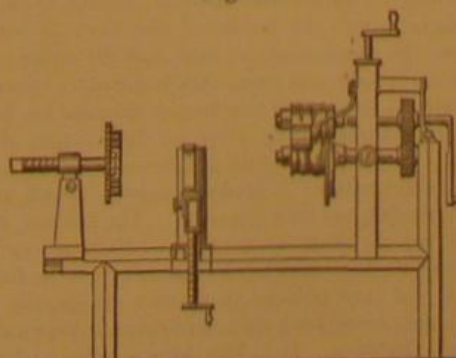
Fig. 11 is a machine of the nature of a screw stock to cut a thread on the end of a wrought iron pipe. It is fitted for hand power, motion being transmitted to the several parts by means of gearing; the pipe is shown projecting toward the left, and is held stationary by the adjustable jaws of the pipe vise. The pipe passes through the center of the gear wheel, the rotary motion of which is imparted to the die in the die box by means of studs or guides upon which the die box freely slides forward as the die passes upon the pipe.

Fig. 11.



The Chase Pipe-Cutting and Threading Machine.

Fig. 12.

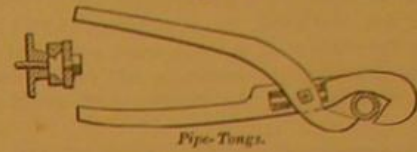


Machine for Threading Sheet-Metal Pipe.

Fig. 12 is a machine in which sheet metal pipe is passed between the two rotating circumferentially ribbed cylinders, the ribs of the cylinders meshing together. As the cylinders rotate they impress the thread upon the pipe.

Fig. 13 represents a pair of tongs with one short jaw

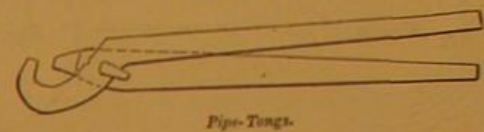
Fig. 13.



Pipe-Tongs.

adapted to grasp a pipe or rod. Their range of grasp is but limited, and a number are provided for varying sizes of pipes.

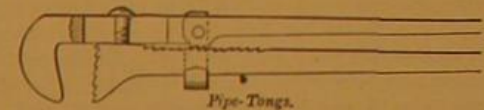
Fig. 14.



Pipe-Tongs.

Their grasp is more tenacious than that of a monkey wrench. Varieties of the implement are illustrated in Figs. 14 and 15.

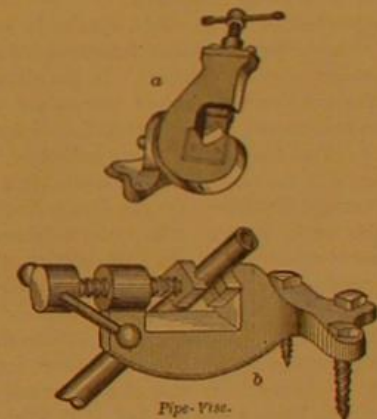
Fig. 15.



Pipe-Tongs.

Fig. 16 is a pipe vise or implement for holding a pipe while being threaded or otherwise fitted; *a* and *b* are different patterns, both for bench use.

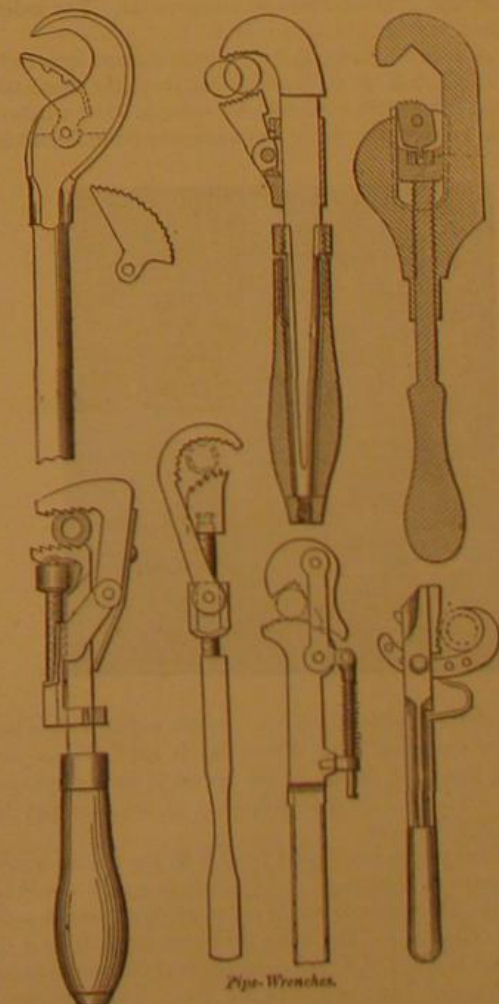
Fig. 16.



Pipe-Vise.

Various forms of pipe wrenches are illustrated in Fig. 17. The instrument is usually made with a movable and a relatively fixed jaw, so arranged as to bite together when

Fig. 17.



Pipe-Wrenches.

they are made to grip the pipe, and are revolved in a certain direction around it. The figure shows several kinds, which will be understood without specific description.

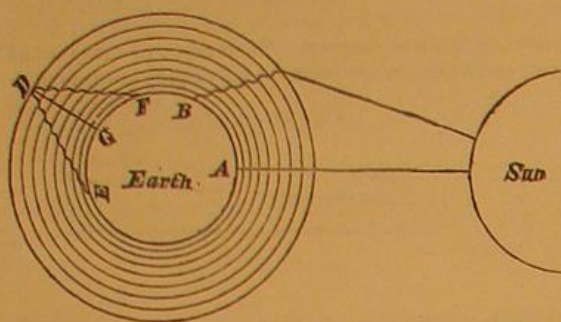
Communications.

The Undulatory Theory of Light.

To the Editor of the Scientific American:

Permit me to submit the following for the purpose of reconciling the undulatory or wave theory of light to that of the straight-line theory of Sir Isaac Newton.

Let the inner circle represent the earth, the outer circle the exterior surface of the earth's atmosphere, and the inner lines the lines of temperature of the atmosphere. An observer, standing on the earth at A, at the moment when that portion of the earth was nearest to the sun, would notice that light travels in a straight line. An observer at B would witness



the undulatory or the wave motion of the light passing in an oblique direction through the various degrees of temperature of the earth's atmosphere. A light at D would travel in a straight line to G; but it would be seen traveling in waves, if an observer were at E or at F. In like manner, sound would travel in waves from E to F, but in straight lines from D to G, and in waves from D to F, D to E. It seems to me that both theories are correct. One of the two may be the general rule, and the other the exception.

Montreal, P. Q.

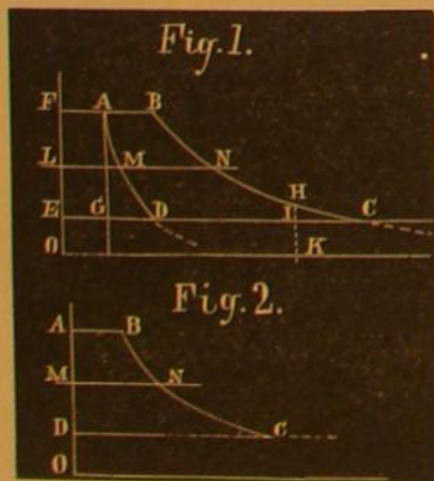
DUGALD MACDONALD.

Steam Economy Computations.

To the Editor of the Scientific American:

Your correspondent of Salem, Ohio, speaks in your issue of May 26 of "the proper allowance for clearance and compression" in steam engine cylinders. If the allowance referred to is for securing the highest percentage of useful effect from the steam used, the method indicated for making that allowance differs from at least one authority, which is regarded by many as the very highest on the subject of steam engineering, namely, Rankine "On the Steam Engine." On page 420 of this work, it says: "In order to represent the most advantageous adjustment of the compression, the quantity of steam confined or cushioned is just sufficient to fill the clearance at the initial pressure." No demonstration of this is given in the work, as applying directly to this problem; but from principles set forth in the chapter, it can readily be shown to be correct. It may also be made plain by the aid of diagrams, Figs. 1 and 2. Let O E, Fig. 1, represent the atmospheric pressure, O F the absolute pressure of admission, G C the stroke of the piston, and E G the clearance, such that, if G C is the volume of the cylinder, E G is the volume of the clearance: A will then be the initial position of the piston, B the point of cut-off, B H C the curve of expansion, and A D the curve of compression. The indicator diagram will then be A B C D A.

Many assume the curve, B H C, to be a common hyperbola, with O F and O K as asymptotes; but both the theoretical and actual curves differ considerably from it. But whatever it be, it is evident that the operations going on in describing



B C are simply repeated, in the reverse order, with a less quantity of steam, in D A. From this it appears that any horizontal line, L N, is cut by the curves in such a manner that FA:FB::LM:LN::ED:EC, etc.; or we may put it: AB:FB::MN:LN, etc.

Now if the piston could start from E F, the engine would virtually have no clearance; and the indicator card would be F B C E F. All engineers would say that this diagram has no loss due to clearance. But when the piston starts from A G, the diagram is A B C G A, the compression being suppressed, and the clearance supposed to be A F E G. The same steam is used as before; but the work done is less than before, in proportion to the decrease, A F E G, of card area. In other words, a diagram indicating no loss due to clearance should

have its back line stand in the same relation to the expansion curve as E F does to B C; and A G is not thus conditioned. But the above proportions show that A D would be thus conditioned, if A D and B C could be so modified as to make A D vertical, and preserve the horizontal secants, M N. On another set of right-angled axes, we may do this by laying off A B, M N, etc., as indicated in Fig. 2: when we get a card shorter, but the same in kind exactly, as F B C E, Fig. 1, already shown to be free from clearance loss. Hence, when an engine must have clearance, it can only be compensated for by cushioning in such a manner that the terminal pressure of compression equals the initial admission pressure. The above discussion supposes that the expansion is carried to C; but if the release occurs at H, there will be a loss, H C I, due to earlier exhaust. If the release line, H I, could be made parallel to D M, the corresponding line in Fig. 2 as E F B H I E, Fig. 1, and as good as is obtainable from an engine without clearance and a square release line.

In designing common D slide valves of engines, the clearance, A F, should be known, so that the point, D, may be found; G D being greater, evidently, as A F is greater. The practical effect of giving large clearance, and hence early cushioning, is to increase the inside lap of valve, increase the angular advance of eccentric, and increase the expansion by making the cut-off earlier. With a clearance of a tenth or twelfth of the cylinder volume, the cut-off may be brought back to half-stroke with all the other points favorably conditioned.

S. W. ROBINSON,

School of Mechanical Engineering, Illinois Industrial University.

Fast and Slow Grinding.

John M. Truax, a prominent and practical New England miller, in a recent communication on the above subject, writes as follows:

"I have heard and read a great deal about slow and fast grinding, and how to dress and how not to dress a mill, etc., etc. Many good millers have related their experience, and made elaborate arguments to prove their theories, and have done much to enlighten their brethren in the milling science, all of which is commendable. But to say who has hit the nail on the head would be hard to tell. If the nail has been hit, who has counted the effect of the blow? To my mind, the reasons given for fast or slow grinding have not been shown. The quantity to be ground must depend upon the texture or density of the stone, the draft, the number and depth of furrows, and the grinding without heating. No more grinding should be done than can be done without heating. The heating is the stopping spot. The quantity that every mill ought to grind is that quantity that can be ground and not heat, whether it is 5, 10, or 20 bushels per hour. If every miller will observe this as his guide, he will do the best work that he is able to do.

"In speaking of heating, I mean to say that the grain should not be so heated by pressure or rubbing, as will start the juice or essential oils of the grain. If the grain oil is started by friction, that friction produces heat, and that heat dries and evaporates the grain juice, and the virtue of the flour is impaired. Any amount of cooling will not repair the damage done by heating. The steam that rises from the hot running mill is the vapor from out of the essential oils of the grain, and is lost in the bread. To recommend the grinding of 10, 15, or 25 bushels of wheat per hour is bad advice, imprudent. Millers differ in the selection of stones, and differ about their dress and the motion of their mill. One will have one kind and way, and another another kind and way; but whatever way they select, when they go to grinding, their quantity per hour should be that which they can grind and not heat, whether it is 3, 5, 10, or 20 bushels per hour. Do not impair the substance for the bulk per hour. Blood heat is as high as can be warranted without impairing the product. It may be an ambition to grind fast, but an old adage is 'haste makes waste.' If millers are ambitious, let that ambition be applied to the making of a perfect running mill. Select the very best buhrs, and put in a thoroughly common-sense dress, a dress that will granulate the whole kernel as nearly as possible. Keep the stones as far apart as possible, and keep the texture or grain of the stones clean. Let this be the miller's ambition. But stop adding to quantity when the mill is at blood heat, and let the breadmakers and eaters have in their flour all the virtue that Mother Earth has produced.

"One of the great evils in milling is low grinding, and its evil effects are only second to those produced by fast grinding. Wheat is composed of two parts—an inner and an outer part. The inner part is meaty, and the outer is a shuck, or skin, or hull; the meaty is pulverizable, while the hull or covering is a leather-like substance, and has thickness, which thickness equals the meshes of No. 14 or 15 bolting cloth. Now, the question arises, how shall the miller grind this compound kernel and clean this leather-like covering, and granulate the inner meat to a proper fineness for bread purposes, and not over-rub or grind to dust a part of the hull? This is the question. And how is wheat being ground all over the world to-day? I need not answer, for all know that heavy grinding has been the order. The lands or faces of one buhr rub the other, or nearly so. So much so that that portion of the bran which is caught between the face of the mill near the skirt is more than twice overground, and this overgrinding or rubbing the bran makes a brown dust, and blackens the flour. It is like brown paint, and bolts with the flour and goes into the bread.

"This is a mistake, and should be avoided. Bran may

make bread, but not the bread millers feel proud of. And to avoid this, millers must run a light mill. Heavy grinding is an evil. It not only powders a portion of the bran and blackens the flour, but grinds at the same time a portion of the kernel to dust, also destroying its juicy substance; and at the same time the fine ground dust is rubbed into the texture of the stone, and the face of the stone becomes glazed and smooth, and of course dull.

"Millers, so dress your mill as will enable you to grind the inner part of the kernel to flour, and avoid making brown paint dust from the bran. A miller that runs a heavy mill is like to look for a medicine to doctor his flour. Medicine for flour is a poor substitute for a good dress and clean stones. Bread-eaters much prefer the full life of the cereals, not a doctored article. Grain once killed by overgrinding and heating will not be brought to life by the best medicines. All the flour doctors in the world cannot repair the life that is first produced in natural growth. They may help a deadened flour, but a whole reparation is impossible. Throw away the dregs! Let us have a pure flour."—*Mill Stone*.

Production of Salt in England.

Of the many minerals raised in the kingdom few play a more important part, or are less noticed, than that which is found in every household throughout the land—salt. It is an essential that we could not dispense with, not only as a culinary ingredient, but in many other ways. Our resources, too, are such that they have not only been fully equal to the wants of our own population, but we have been able to spare yearly from 200,000 to 250,000 tons to other countries that are not so favored as ourselves. There are districts in many parts of the country where salt could be met with were such necessary, for, some time since, whilst boring near Middlesborough, in the expectation of meeting with the coal measures, rock salt was met with at a depth of 1,800 feet. At the Moira Colliery, near Ashby-de-la-Zouch, in Leicestershire, at a depth of 593 feet, salt water, beautifully clear, trickles down from the fissures where the coal is being worked. The brine is taken to Ashby, and has been in good repute for rheumatic and other complaints. As to the origin of salt, there are many theories, but it may be stated that in nearly all substances, wherever found, it is in the new red sandstone. By many it is believed that the formations are due to the evaporation of the water from inland salt lakes or parts of the sea severed from the main body of the ocean by volcanic action, the evaporation causing the deposit of the salt held in solution by the sea. Writing more recently on the subject of the great European salt deposits, Mr. T. Ward propounds a rather different theory. He considers that the salt deposits owe their origin entirely to the elevation of the mountain chains with which they are so intimately connected, during which small valleys and ravines would be cut off from connection with the sea by ridges of land, and would form salt lakes and lagoons. Cheshire is still the main source from which we draw our own supplies, and export to the United States, Russia, and other countries. There we have had considerable landslips in working it, but there are the red rocks showing keuper or saliferous marl, with thin beds of limestone, and then 200 feet of rock salt. In Worcestershire, at Droitwich and Stoke Prior, the salt is made from brine alone. A large proportion of what is made at Norwich, Middlewich, and Winsford, in Cheshire, is sent down the river Weaver, the quantity in 1857 having been 772,175 tons, and in 1866 it had increased to 1,118,991 tons. During the last 20 years, however, the increase in the production has been of a most marked character, whilst the price has gone down very much. In 1855 the salt raised in the kingdom was 1,094,770 tons, the average price at the works being about \$6 per ton. In 1875 there was raised 2,316,644 tons of salt, the price being barely \$3.60 per ton. The value of the salt exported in 1855 was \$1,738,570, and in 1875 it was only \$860,255, when our exports were 916,468 tons, or nearly as much as the entire produce of the kingdom in the former year. Our principal customers include the United States, British India, British North America, and Russia. From the figures given it will be seen that nearly 40 per cent of the salt produced in the kingdom is exported to other countries.—*Mining Journal*.

GAUGES.

Since the introduction of special machines and tools designed to produce and reproduce the various parts in quantities, and of exactly uniform size and shape, the importance of standard gauges has been greatly increased; and in establishments where this system is followed, the best of skill and the greatest of care and watchfulness are necessary to maintain the exact standard. It is obvious that, when the various parts of a piece of mechanism are made separately in large quantities, and are not assembled until the whole are finished, a slight variation of size or form would soon impair the fit of the various parts, and therefore the value of the whole system. Now, theoretically, a new tool decreases in size from the moment it commences to perform cutting duty until it is worn out; and the point at which the wearing-out process may have arrived at its greatest permissible limit is, under light duty, more often determined by the reduction of its size than of the loss of its keenness or other cutting properties. Many firms prescribe a definite permissible limit of wear to certain tools, such as the one thousandth or two thousandth of an inch, and make two sets of gauges, one of the precise size and the other showing the extreme

limit to which the range of size is permitted; and when that limit is reached, the tool maker or foreman is notified that the tool may be restored to its standard. For the purpose of this restoration a standard gauge is required; and this gauge even is subject in some degree to wear, especially if it be not handled with extreme delicacy. No more delicate proof of this fact can be shown than in the following: If we take a pair of cast iron surfaces, having an area of 100 inches, and clean them thoroughly with alcohol, and then, after freely lubricating them with the best sperm oil, rub one a few strokes upon the other, we shall find that (though, from the existence of the oil, neither the eye nor the sense of feeling gives the least indication that the surfaces have had the least contact) still the oil will have become so darkened, or rather blackened, in color as to clearly demonstrate that abrasion has, to some practical extent, taken place. From this we may perceive that, in trying hardened steel tools with gauges, the latter, though of hardened steel themselves, may very easily become worn if rudely handled.

The gauges used as standards for male and female cylindrical forms are usually after the pattern shown in Figs. 1 and 2. They are made of steel; and after being hardened they are ground to size, the grinding process being so delicately performed as to leave a polish. In testing such gauges the

Fig. 1.

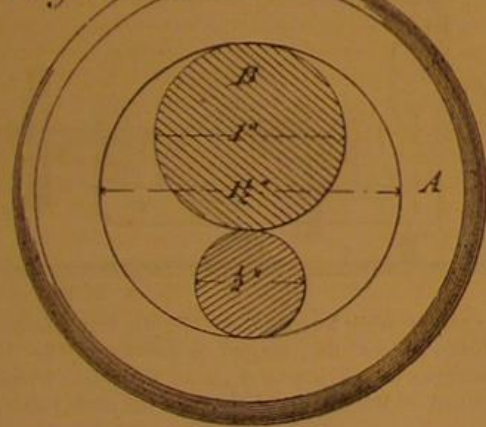


Fig. 2.



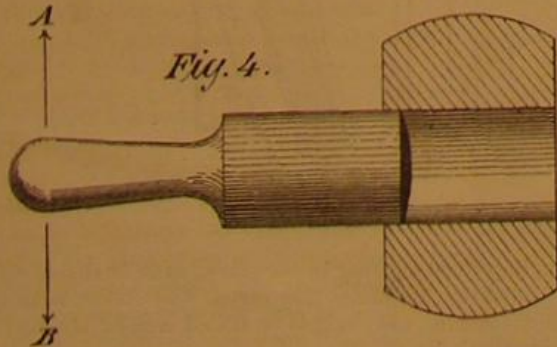
heat imparted to them by holding them for any length of time in the hand will cause a perceptible difference in the size; hence, to insure the greatest practicable accuracy, it is necessary to test the whole set at an equal temperature. As a test of accuracy, we may take a female gauge and place therein two or three male gauges, whose diameters added together will equal that of the female. Thus in Fig. 3, the

Fig. 3.



size of the female gauge, A, being $1\frac{1}{2}$ inches, that of the male, B, may be 1 inch, and that of C $\frac{1}{2}$ inch, and the two together should just fit the female. On the other hand, were we to use, instead of B and C, two males, $\frac{1}{2}$ and $\frac{1}{2}$ inches, respectively, they should fit the female; or a $\frac{1}{2}$ inch, a $\frac{1}{4}$ inch, and a $\frac{1}{4}$ inch male gauge together should fit the female. By a series of tests of this description, the accuracy of the whole set may be tested; and by judicious combinations, a defect in the size of any gauge in the set may be detected. A notable fact with reference to these gauges is that, if we take a male and female of corresponding sizes, and slide the one continuously through the other, it will pass through at a

Fig. 4.



proper fit; but if we arrest the progress of the male and allow it to rest a few moments, it will become fast in the female and require considerable force to remove it again. The wear of these gauges takes place most rapidly at and near the ends, because it is difficult in using them to keep them in lines true with the bores into which they are tried; and the movement due to the adjustment to line causes abrasion. It is indeed an excellent method of testing to place one in the other to the depth of about $\frac{1}{4}$ of an inch, as shown in Fig.

4; and holding the female firmly, lightly press the male first in the direction of A and then of B. There are few gauges which will not, under such a test, show some slight movement, denoting defect.

Solid cylindrical tools are often made of steel wire drawn to gauge, and to great accuracy of diametrical size. There is, however, a slight degree of variation due to the wear of the drawing dies. In the table below will be found the gauge numbers, and the sizes in decimal parts of an inch of the celebrated Stubbs wire. The first column is the size according to the Stubbs wire gauge; the second is the size in decimal parts of an inch, as given by Mr. Stubbs; and the third column represents the average sizes obtained from actual measurements of the wire, taken during a period of several years by the Morse Twist Drill and Machine Company, whose drills are made to great diametrical accuracy.

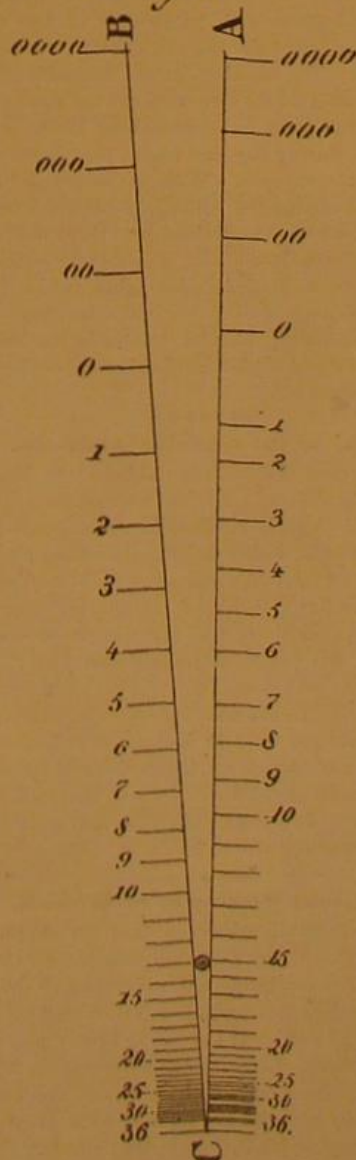
DIAMETER OF STUBBS' STEEL WIRE IN FRACTIONAL PARTS OF AN INCH.

No. by Stubbs' Wire Gauge.	Stubbs' Dimensions.	Measurement by Morse Twist Drill and Machine Co.	No. by Stubbs' Wire Gauge.	Stubbs' Dimensions.	Measurement by Morse Twist Drill and Machine Co.
1	0.227	0.228	23	0.153	0.154
2	0.219	0.221	24	0.151	0.152
3	0.213	0.213	25	0.148	0.150
4	0.207	0.209	26	0.146	0.148
5	0.204	0.206	27	0.143	0.145
6	0.201	0.204	28	0.139	0.141
7	0.199	0.201	29	0.134	0.136
8	0.197	0.199	30	0.127	0.129
9	0.194	0.196	31	0.120	0.120
10	0.191	0.194	32	0.115	0.116
11	0.188	0.191	33	0.112	0.113
12	0.185	0.188	34	0.110	0.111
13	0.182	0.185	35	0.108	0.110
14	0.180	0.182	36	0.106	0.106
15	0.178	0.180	37	0.103	0.104
16	0.175	0.177	38	0.101	0.101
17	0.172	0.173	39	0.099	0.100
18	0.168	0.170	40	0.097	0.098
19	0.164	0.166	41	0.095	0.096
20	0.161	0.161	42	0.092	0.094
21	0.157	0.159	43	0.088	0.089
22	0.155	0.156	44	0.085	0.086

The following table represents the letter sizes of the same wire:

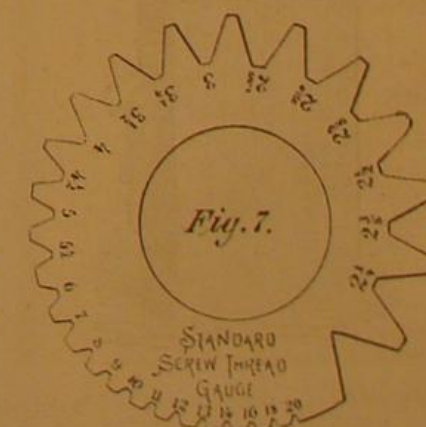
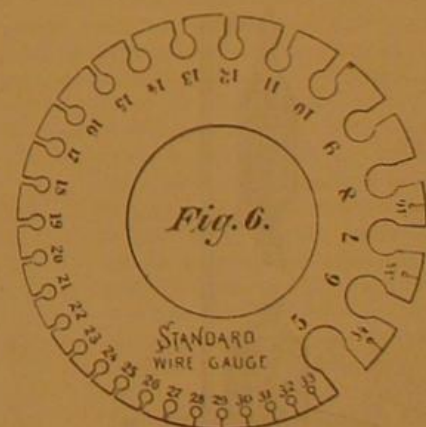
LETTER SIZES OF WIRE.					
A	0.234	J	0.277	S	0.348
B	0.238	K	0.281	T	0.358
C	0.242	L	0.290	U	0.368
D	0.246	M	0.295	V	0.377
E	0.250	N	0.302	W	0.386
F	0.257	O	0.316	X	0.397
G	0.261	P	0.323	Y	0.404
H	0.266	Q	0.332	Z	0.413
I	0.272	R	0.339		

Fig. 5.



duce greater uniformity in the progression of the sizes. This will be clearly understood by reference to the diagram shown in Fig. 5, in which the two lines, A C and B C, meeting at C, represent the opening of an angular wire gauge. The divisions on the line, A C, show the size of wire by the common gauge; those on the line, B C, the sizes by the new American standard. Wire to be measured by such a gauge is passed into the angular opening until it touches on both sides, the line of division at the point of contact denoting the size by wire gauge number. Thus No. 13 by the old gauge is No. 15 by the new. The difference between the two gauges, known respectively as the Birmingham or English and the American, is shown in the table below:

No. of Wire Gauge.	AMERICAN OR NEW STANDARD.		BIRMINGHAM OR OLD STANDARD.	
	Size of each Number in decimal parts of an inch.	Difference between consecutive Nos. in decimal parts of an inch.	Size of each Number in decimal parts of an inch.	Difference between consecutive Nos. in decimal parts of an inch.
0000	0.460		0.454	
000	0.40664	0.05036	0.425	0.029
00	0.36480	0.04184	0.380	0.045
0	0.32495	0.03994	0.340	0.040
1	0.28930	0.03556	0.300	0.040
2	0.25763	0.03167	0.284	0.016
3	0.22942	0.02821	0.259	0.025
4	0.20431	0.02511	0.238	0.021
5	0.18194	0.02237	0.220	0.018
6	0.16202	0.01992	0.203	0.017
7	0.14428	0.01774	0.180	0.023
8	0.12849	0.01579	0.165	0.015
9	0.11443	0.01406	0.148	0.017
10	0.10189	0.01254	0.134	0.014
11	0.09074	0.01105	0.120	0.014
12	0.08081	0.00993	0.109	0.011
13	0.07196	0.00885	0.095	0.014
14	0.06408	0.00788	0.083	0.012
15	0.05707	0.00702	0.072	0.011
16	0.05082	0.00625	0.065	0.007
17	0.04526	0.00556	0.058	0.007
18	0.0403	0.00495	0.049	0.009
19	0.03589	0.00441	0.042	0.007
20	0.03196	0.00393	0.035	0.007
21	0.02846	0.00350	0.032	0.003
22	0.02535	0.00311	0.028	0.004
23	0.02257	0.00278	0.025	0.003
24	0.0201	0.00247	0.022	0.003
25	0.0179	0.00220	0.020	0.002
26	0.01594	0.00196	0.018	0.002
27	0.01419	0.00174	0.016	0.002
28	0.01264	0.00155	0.014	0.002
29	0.01126	0.00138	0.013	0.001
30	0.01002	0.00123	0.012	0.001
31	0.00893	0.00110	0.010	0.002
32	0.00795	0.00098	0.009	0.001
33	0.00708	0.00087	0.008	0.001
34	0.0063	0.00078	0.007	0.001
35	0.00561	0.00069	0.005	0.002
36	0.005	0.00061	0.004	0.001
37	0.00445	0.00055		
38	0.00396	0.00049		
39	0.00353	0.00043		
40	0.00314	0.00039		



The gauge adopted by the sheet brass manufacturers of this country is shown in Fig. 6; and in Fig. 7 is shown the Franklin Institute or American standard screw gauge.

American Leather in Germany.

The United States Consul at Berlin, under date of May 1, in view of the fact that from its superior quality American leather is gradually finding its way to Germany, submits a prospectus of an exhibition of leather manufactures, to be held in that city from September 8 to 29 next. The Consul thinks an observance of the provisions of the documents would be beneficial to American interests.

The American standard wire gauge was introduced by Messrs. J. R. Brown and Sharpe, the object being to intro-

NEW FEATHERING PADDLE WHEEL.

Mr. Henry Williams, of Milwaukee, Wis., has patented through the Scientific American Patent Agency, April 3, 1877, a new paddle wheel in which the paddles or floats are feathered in passing into and out of the water. As shown in the engravings, the wheel carries a number of journaled radial arms, *b*, having at their outer extremities paddles or floats, *B*, which are turned through a quarter of a revolution by T levers, *c*, attached to the inner ends of radial arms, which carry a friction roller, *e*, at each end. These friction rollers move in a cam, *C*, of peculiar construction, which turns the T levers, and consequently the floats or paddles, at the proper instant.

The feathering part of the cam, *C*, is placed so that the paddles are turned at right angles to the plane of rotation as they enter the water, but are turned edgewise or parallel to the plane of rotation before they begin to rise in the water.

The Scientific American.

"THE SCIENTIFIC AMERICAN for last week contains some excellent illustrations of the great engineering work of the Delaware, Lackawanna, and Western Railroad in tunneling Bergen Hill, also a description of its progress and the expense of constructing this great addition to the railroad interests of our State, together with many other matters of interest. Mechanics and artisans, and indeed professional men generally, who desire to keep well posted in the science of mechanics, and thus attain greater usefulness in their respective professions, can make no better investment of a few dollars than by subscribing to so valuable a periodical as the SCIENTIFIC AMERICAN."—*Somerset (N. J.) Gazette.*

WILKINSON'S IMPROVED LIQUID MEASURE.

We illustrate herewith a convenient apparatus for grocers' use, designed for drawing kerosene oil in the store directly from the barrel in the cellar. It is so made that the hands need not come in contact with the oil; and it saves the time of traveling to and from the cellar whenever oil is to be drawn. At the same time, it affords an accurate means of measuring out the liquid, even to the smallest quantities; and it prevents evaporation of the same, and also chance contact with fire during handling.

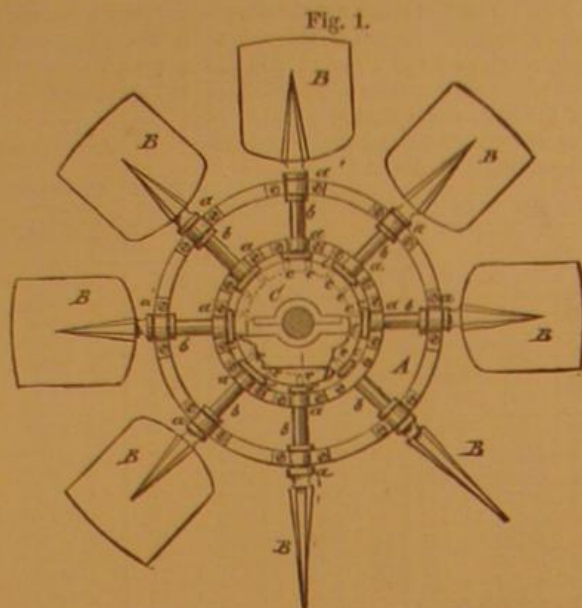


The device consists of a pump, shown beside the stand in the engraving, which is connected to the oil cask by a tube which extends upward and communicates with the upper portion of a glass measure, which is marked with a graduated scale to represent gills, pints, quarts, etc. The construction is such that, when the stopcock is opened to draw off the fluid, a valve is also opened, and air is admitted to the top of the receptacle. When the measure is being filled by pumping the fluid into it, the air will open the upper valve and escape, the valve afterwards closing and preventing evaporation. The apparatus is made in any desired size and with any graduation.

Patented June 13, 1876, by Mr. J. W. Wilkinson. For further particulars, address the manufacturer, Mr. H. J. Appleby, 911 Market street, Meadville, Pa.

Science in Mexico.

We are indebted to the Hon. C. Vincente Riva Palacio, Minister of Fomento, of the Republic of Mexico, for a copy of the first volume of the *Anales* of that department. It is a very handsomely printed document of 208 pages. President Diaz has directed the publication, under the above title, of such scientific matters as the Minister may deem to be of public interest.



WILLIAMS' FEATHERING PADDLE WHEEL.

It would appear from this publication that President Diaz is a zealous friend of Science, and that he is disposed to do all within his power to advance the cause of scientific progress in Mexico. One of his earliest proclamations was in relation to the formation of a national astronomical observatory. The elegant palace of Chapultepec has been permanently dedicated to this purpose. A meteorological and magnetic observatory has also been provided for on the same premises. The plans for construction are practical and effective. The situation is one of the finest in the world for an observatory. Excellent lithographic plans of the projected new observatories are given, also a telegraphic map, with an account of the Mexican system of telegraphs, about eight thousand miles in extent, worked chiefly by the government. President Diaz also recently ordered a survey for a new branch canal, to facilitate the transportation of produce from the narrow country near Mexico to the railway, and Mr. Edward Davis, C.E., has surveyed an effective and economical route therefor.

Some very interesting information is given concerning the earthquakes of Jalisco, with particulars of the volcano of Ceboruco, which latter has been in a state of constant eruption since 1870. The members of the Scientific Commission established themselves for two weeks at the rancho of Uzeta, 2,000 feet distant from an approaching bank or stream of lava; and here, during day and night, they instituted observations and made surveys. With incredible difficulty they succeeded in ascending the volcanic peak and looking down into the crater, which was divided into three mouths, one of which belched forth flames and stones every eight minutes; the others poured out smoke and ashes; while two lateral streams of lava slowly flowed out sidewise from below the peak. The concluding chapter relates to the Mexican department of the Philadelphia Exhibition, gives the names of Mexican exhibitors, etc.

Value of the Scientific American.

"THE SCIENTIFIC AMERICAN, published by Munn & Co., of New York, is without a rival as a scientific paper, and to the mechanic is simply invaluable. We honestly believe any mechanic would derive information from a year's reading of the SCIENTIFIC AMERICAN which any amount of money could not buy. Some of our enterprising mechanic citizens, we hope, will try the experiment of reading this really valuable and practical journal one year. We know they would never give it up."

[Notices similar to the above (from the Glasgow Weekly Times) often meet our eyes in looking over our exchanges. We thank our contemporaries for their good opinion of the SCIENTIFIC AMERICAN, and wonder why the class of persons referred to above do not all subscribe and gain the benefit which they are assured would be theirs.—Eds.]

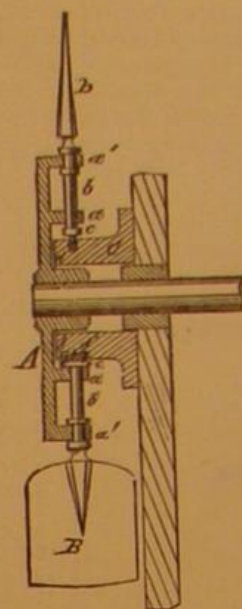
Electrical Treatment of Wounds.

M. Onimus has lately observed that the suppuration of wounds or ulcers may, by means of continuous electric currents, be increased or diminished, according to the direction of the current. The descending current, that is, when the positive pole is placed near the nerve center and the negative at the periphery, increases the suppuration, but, at the same time, the phenomena of nutrition are more considerable, and the fleshy pimples are formed with great rapidity. On the other hand, with the ascending current, the suppuration disappears very quickly. A small crust forms on the wound, which is difficult to remove, and under it there is a cicatrization.

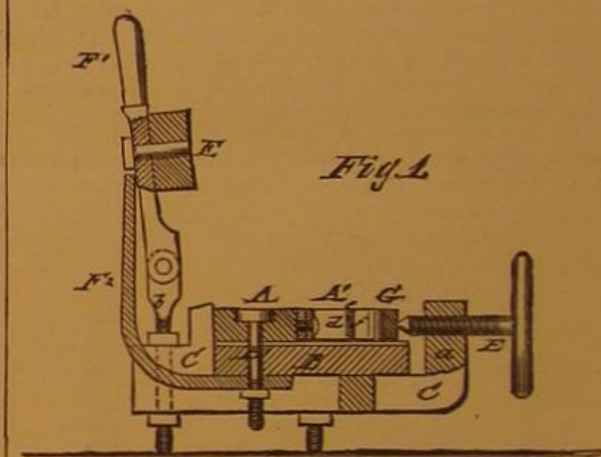
IMPROVED MACHINE FOR SHAPING SPRINGS.

Mr. E. C. Lewis, of Auburn, N. Y., has patented through the Scientific American Patent Agency, March 27, 1877, a novel machine, which we illustrate herewith in plan and section, for automatically shaping or fitting springs in perfect and quick manner, by any unskilled workman, so as to supersede the present imperfect method of pinching the heated spring leaves or plates into form by means of tongs.

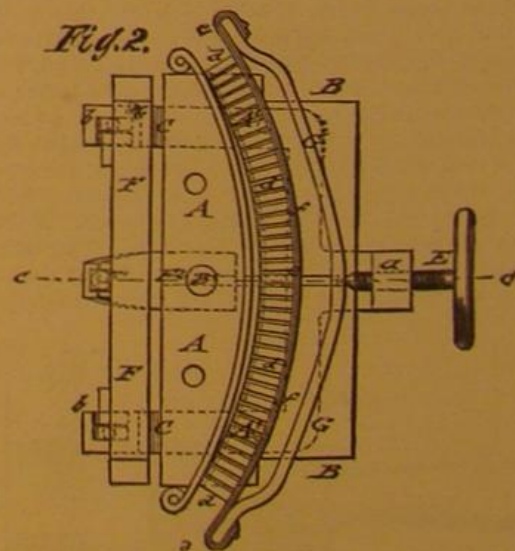
A represents a solid former, and A' a flexible former, which are both supported on a bed plate, B, the solid former being secured thereto by a screw bolt, B'. The bed plate, B, rests on suitable supporting standards, C, which carry at one side an upright arm or post, *a*, with screw cam or knuckle device, E, and at the opposite side posts, *b*, to which a solid drop, F, with handle, F', to operate the same, is hinged, and supported in upright position by an arm, F², of the bed plate. The drop block serves to straighten the edges of the plates in conjunction with the bed plate, while they are shaped by the formers. The solid former, A, may be interchanged for the purpose of shaping springs of different sizes, while the flexible former, A', is adapted to fit any size and shape of springs. The flexible former is constructed of a number of steel lugs, *d*, which are riveted to a band, *e*; or when the shaping machine is made in larger size, the lugs are connected in such a manner as to form a continuous chain, each lug forming a link. A second band, *f*, bears on the back of the first band, or directly on



the connecting links of the lugs, and is attached at the ends to a rigid bow-shaped bar, G, to the center part of which a compressing screw bolt is applied. The lugs are channeled along the center, the channels running in the direction of the longitudinal axis of the former. The object of the channels is to produce the instant chilling of the edges of the



leaves or plates, while leaving them slightly warm at the center to draw down the temper somewhat. The heated plates are placed on a center pin of the solid former, and then exposed to the action of the cold formers, which are



strongly pressed together by the screw, so as to shape, chill, and temper the hot plate. The plates, when taken from the shaping machine, are ready to be bolted, and require no further manipulation.

PROFESSOR TAYLOR, of Chicago, accompanied by Lieutenant Wood, U.S.A., with all the instruments for scientific exploration, recently left Victoria, B. C., for Sitka, to make a survey of the famous snow peak, Mount St. Elias, and ascertain its altitude. It is situated 350 miles north of Sitka, and has never been ascended yet, and its height has not been determined. The result of the exploration will be reported by the department at Washington.

PERUVIAN ANTIQUITIES.

The plateau of Ancon, in Peru, is an arid table land overlooking the sea coast and situated about 12 miles northwest of Lima. It is the location of a vast sepulchre, dating back to the earliest historical periods. Owing to the dryness of the air and the impregnation of the soil with salts, the contents of the tombs are finely preserved; and, as was apparent from the collection of mummies exhibited at the Centennial, even the lapse of ages has not determined the disappearance of either skin or hair. Fabrics, wooden vessels, and food have been found in the tombs in perfect condition: and as it was the custom of the ancient people to inter with their dead their choicest ornaments and objects of utility, a rich treasure is now open to antiquarians, from which it is possible to determine the habits and manner of life of the Peruvians during the period prior to the Spanish conquest.

A collection of these relics now exists in Paris, at the Musée de St. Germain, and is to form a portion of a still larger gathering relative to ancient life in America, which is to be exhibited at the French Exposition of 1878. Several of the more interesting objects are represented in the annexed engravings, for which we are indebted to *La Nature*.

There was recently exposed for sale in this city a collection of Peruvian remains, which were sold at ridiculously low prices. The condition of the objects was scarcely such as to tempt the collector of bric-a-brac, however interesting they might have been to the antiquarian; but despite the prevalent dilapidation, we noted, on examining the articles, the remarkable state of preservation of the woven fabrics—a circumstance which our contemporary also considers the most phenomenal feature in the fine French collection; not only is the tissue intact—as our engravings indicate—but the colors have kept their primitive brilliancy, and this although the fabrics seem but rough specimens of woolen weaving. The designs are always either fantastic or combinations of geometrical figures. Grotesque representations of animals are frequently introduced, as witness the remarkable cubical birds and the geometrical cats shown in Fig. 1. The man represented is an astonishing figure: and it will be noticed that he is provided with but four toes or fingers on the respective limbs. This is an invariable peculiarity in the pictures of the ancient artists of the country, which has not yet been accounted for. On the right of the engraving are two birds, which look like geese or swans, and which, strange to say, closely resemble the birds of like species represented on ancient Etruscan vases. We can commend these designs to those who are searching for new grotesqueries for Eastlake rugs. Mr. Eastlake suggests figures of animals not accurately drawn but possessing character, and these certainly answer the requirements.

Besides manufactured fabrics, distaffs and spindles, used for spinning the cotton or llama wool yarn, of which they are woven, have been found. The spindles, F, Fig. 2, are often ornamented with pearls and are gaily painted. Hanks of yarn and hand looms, the latter roughly made of sticks, have been exhumed, and even pins and needles. The pins are simply long thorns, the thick portion at the point of junction with the branch serving as the head. The needles are the same, having a hole for the thread.

In Fig. 2 are represented a number of other curious articles. D is a wooden spoon with carved handle; A is a llama in pottery; and B a terra cotta statuette of a woman; G and E are pendants in mother-of-pearl and ebony. H is an ivory ornament; and C is a red earthen vase representing a man seated.

Not only are objects of metal and wood found in the tombs, but some beautiful specimens of glassware have been obtained. The glass is perfectly clear; and as there is no evidence that the people possessed the material for making it, it would follow that it was imported; but whence, it is impossible to tell. The glass vase represented in Fig. 1 is of light blue color, ornamented with opaque white glass, which bears the traces of gilding. The ornamentation bears no resemblance to that commonly employed by the Peruvians, and thus another proof is added of its foreign origin. The handle and the neck were made separately, and fastened on afterwards in a manner which shows

superior skill on the part of the workman. The neck is ornamented with a kind of griffin's head, which has no resemblance to any animal indigenous in Peru. It is supposed to have been brought from Asia, as it is believed that the Japanese and Chinese knew of the New World and maintained commerce with the inhabitant long before the discovery.



PERUVIAN ANTIQUITIES, MUSÉE DE ST. GERMAIN, PARIS.—Fig. 1.

ery by Europeans. But the decoration is not Oriental, but strictly Spanish; and hence the more probable assumption is that the object was brought into the country by the Spaniards in the 16th century, and hence that the Ancon sepulchres were in use at that period.

NEW GUANO DEPOSITS.—An English commission, sent to examine some recently discovered guano deposits to the south of Tarapaca, in Peru, has confirmed the reports of previous explorers as to the immense quantity of the deposit, amounting to at least 10,000,000 tons; and it is richer in ammonia and phosphates than that of the Chincha Islands.

Photographing Machinery.

It is a common practice with large manufacturers of machinery in this country and in England to have photographs taken of their products, especially of any new class of machine, to send to customers. For producing good photographs of this kind, the *British Journal of Photography* makes the following suggestions:

To execute this class of work successfully, every contingency must be provided against—not alone in the direction of chemicals, but in apparatus equally as well. A swing-back camera is indispensable. It frequently happens that the object to be photographed is in such close proximity to the camera itself—some portions of it lying in a plane oblique to that of the camera back—that accurate focusing can only be thus obtained, unless a stop of such diminished aperture be made use of that the exposure becomes so long as to introduce too many elements of non-success. Again: the usefulness of a swing-back will be seen when an object of regular form lies on the ground close to the camera, which latter has to be tilted to get the object in the field of view at all. Here a swing of the back—the top outwards—prevents all want of truth in the perpendiculars, and there will be no fear of the result representing a truly constructed machine with sloping sides and irregular contour.

For the successful prosecution of this class of work a good selection of lenses is necessary. The size of the picture required is generally fixed upon beforehand; and as the standpoint is often of limited area, if not absolutely fixed, there are not afforded the opportunities that landscapists enjoy in the selection of their point of view. The lenses, it must be remembered, should be chosen for their focus—not from their being wide or narrow-angled, quick, or slow. Let the latter qualities, of course, govern one in deciding; but the focus of the various lenses should so rise, step by step, that, wherever the point of view may be chosen or fixed upon, one lens may be found among the

series which will take the picture the required size. The lens selected, the diaphragm used should be the largest it is possible to employ with the aid of a swing-back.

It will frequently happen that the object to be photographed lies at one end of a dark workshop. It would, then, be greatly conducive to rapidity and excellence of results if it could be brought forward, perhaps, into the open air; for it very commonly happens that the windows or skylights which illuminate such places are covered over with a fuliginous deposit, which seems to rob the light which passes through them of every particle of actinic power.

At this point it will be well to mention a very useful wrinkle. It will be impossible to get a very satisfactory picture of an iron casting, or, indeed, any metallic object which is not finely polished, unless it be purposely painted beforehand in a special manner—that is, with turpentine flattening—a light slate color being the tone most advisable, as its photographic value can be seen at a glance, without the chance of miscalculation which a green or a brown, for instance, might offer. This will be found to be a matter whose usefulness cannot be too highly valued. The contrast between a machine, no matter how excellently photographed, which has not been specially painted and the same subject with a coating of the flattening, will be so great that no one who has once seen the two would think of photographing an unpainted piece of ironwork if he could possibly avoid it. There is one precaution to be taken in laying the color on which, though it is more especially the painter's province to look after, may be pointed out here: it is that it should be made with so little oil or gold size that it will not dry patchy or cloudy—that is, with some parts dead and some bright. The effect then produced would be worse than if the machine had remained untouched.

During the exposure care must be taken that no workmen are allowed to lounge about and smoke; for it is remarkable what a small amount of smoke will suffice to fog a picture if it blow across the field of view, this being due, no doubt, to the highly actinic quality of the light reflected from the minute particles composing the smoke. We once had an otherwise excellent negative ruined through a similar cause, but from another source. The wind was strong, and carried a puff



PERUVIAN ANTIQUITIES, MUSÉE DE ST. GERMAIN, PARIS.—Fig. 2.

of smoke from a neighboring office chimney right into the open doorway of the room in which we were photographing; it permeated the whole atmosphere of the place, and rendered it impossible to secure a clear negative, though at the moment the occurrence was not noticed.

When the negative is obtained, it will generally be found that the background will be required to be eliminated, plain white paper being generally preferred by manufacturers to show off the peculiarities and excellences of their machines, there being no chance of confusing their details with those of the surrounding machinery in the background. To stop out all these and leave a white background, we have tried a multitude of expedients, but find no plan better than to make an edging of about half an inch by means of Bates' black varnish, carefully following the outlines of the machine as accurately as possible, and then placing a paper mask to block out the whole of the ground left outside this edging. This plan reduces the risk of cracking from the black varnish, and is at the same time more expeditious. We have tried Indian ink, gamboge, and water colors *ad libitum*; but we find it most difficult to obtain the requisite body to stop out all the light, so as to avoid any stain or streak.

We trust that the few points that we have touched upon may tend to render this class of work easier to those intending to try it, and we advise all, from a pecuniary standpoint, to do so when the occasion offers; for it is certain that in time to come photography will be more and more in request for work of this description, and we are in a position to state that, even in small establishments, the annual expenditure for photographs of machinery forms a conspicuous item.

Dangerous Paper Hangings.

The sanitary chemist of Breslau, Dr. Franz Hulwa, reports that he has frequently found not inconsiderable quantities of arsenic in tapestries and hangings sent to him for examination. It was not alone in the well known bright green paper that arsenic was found, but also in bluish green, gray, brown, and red patterns, corresponding to similar results in other places.

In most cases it was not due to the direct use of arsenical pigments like Scheele's green, Paris green, Braunschweig or Brunswick greens, orpiment, royal yellow, etc., but the arsenical reaction was so strong that it ought not to be passed over in silence. The presence of arsenic was attributable in some cases to impurities or adulterations; sometimes it was referred to additions made to brighten the shades of color. Not infrequently suspiciously bright green paper was printed over with harmless dull green to make it more salable. Such hangings must be the more dangerous because people are deceived in regard to their poisonous characters. In one such case, a dull bluish green pattern was found to contain a surprisingly large amount of arsenic. In another beautiful green and very elegant velvet paper, the arsenic was evidently added to increase the brilliancy of the colors. The amount of arsenic on 1,000 square feet of surface of this paper, enough for a large room, was about 2 grammes, or 30 grains.

Lakes, which are precipitates from alkaline solutions of organic coloring matter by means of alum or chloride of tin, frequently have arsenic added to them to make them brighter and more pleasing. These lakes were made of madder, cochineal, and sandal wood; but the brightest and most beautiful are the lakes made with aniline colors with the addition of arsenic. In the lakes we meet with a series of dangerous colors previously but little noticed; these colors must now all be suspected of containing arsenic. Reichardt of Jena found from 1.96 to 3.49 per cent of arsenious acid in such lakes which were designated as free from arsenic. Hallwachs, of Darmstadt, found an enormous quantity of arsenic in a very popular Pompeian red paper hanging. In one French paper, printed with dark red velvet flowers on a gold ground, arsenic was distinctly proven by the Reinsch, Bettendorf, and Marsh tests, and with Fleck's silver solution.

Arsenic is least suspected in the dull gray or brown hangings. These indefinite mixed colors are frequently made from the residues of different dye pots and contain arsenic, partially for this reason, and partially because of the greater or less contamination of the raw materials used in dyeing with this poisonous substance. These phases of the case were observed both in a yellowish gray paper with gold figures, and one of light and dark pattern; the brown contained 2.1 grammes on a surface of 1,000 square feet. Although these figures are relatively small as compared with those of Sonnenschein, where green papers contained 1.8 to 4.4 grammes of arsenic in a square foot of surface, yet in general the injuriousness of arsenical hangings has been established. Gmelin first proved that living in rooms covered with arsenical paint or paper was very destructive to health; and these facts were substantiated by Oppenheim, Bunsen, Von Fabian, Kletzing, Phillips, and others. Beside the above-mentioned investigators, the following chemists have examined this subject, namely, Gintl, Wittstein, Halley, Williams, Basedow, Vohl, Kirchgäser, Hager, Hamburg, and others. Recently Fleck has furnished the most striking proofs, by his very interesting and rationally conducted experiments, that not only does breathing the arsenical dust loosened from the walls and hangings injure the health, but that, by the action of moisture and adhesive organic substances, like glue, paste, and gum, the arsenical pigments evolve that terribly poisonous arseniuretted hydrogen gas, which is diffused through the room and may be the cause of dangerous illness. It is desirable, says Hulwa, to direct public attention to the use of arsenical colors in clothing,

artificial flowers, toys, window and lamp shades, wafers, and other articles. The public must be continually taught that arsenical colors have already done much harm and are capable of seriously injuring the health, and ought, as much as possible, to be excluded from common use. The sanitary police of Breslau, acting on Hulwa's suggestion, have passed an ordinance forbidding the sale of goods colored with arsenical dyes or pigments.

The New German Patent Law.

The new German Imperial Patent Law has just been passed by the Reichstag and will come into force on the 1st of July next. This new law puts an end to the disorder concerning patents in Germany that has existed until now, there being at the present time twenty-one different States granting patents of their own. These will be all embraced by one law after the 1st of July, and this a good and practical one, far better than many now in force in other countries. Pharmaceutical compounds, medicines, alimentary preparations, and chemical products cannot be patented under the new law; processes, however, by which these articles are obtained, can be patented. An invention must be novel, and not have been introduced to the public so that another person can imitate the same. Imported inventions are patentable only to the real inventor. Foreigners must be represented by a German citizen. It is unlawful to manufacture a patent article, to import the same from another country, or even to use without permission a patented machine, tool, apparatus, or process. Any one having an invention in use cannot be prevented from continuing to use the same. A patent remains good for fifteen years on payment of an annual tax. The duty may be paid three months after date. Patent rights may be withdrawn by the government after three years if the invention has not been carried into operation to a proper extent, or if the inventor has not taken the necessary steps to carry the patent into effect, if he refuses licenses to others who offer a fair royalty, or if it is advisable for the public good to grant such licenses. When the invention or improvement relates to purposes of war or marine, or affects the general welfare, a patent will not be granted, but the inventor will be recompensed by the State. The decision in this case will rest with the Imperial Chancellor. Any one having obtained a patent for improvements on a patented article, and wanting a license from the first inventor, is obliged to give the latter a license for his improvements. The applications will be examined by the Patent Commissioners and experts appointed for this purpose; an appeal can be made, in case of refusal, to a special commissioner, and from him to the Imperial Court at Leipzig. In the case of poor inventors, the payment of duty will be postponed for two years, or may be altogether remitted. Specifications and drawings can be inspected immediately after the application; on account of this, patents should be taken in other countries first. Patents being delivered, a short specification of the same will be published in the "Patent Journal." Infringements of patent rights are punished with a fine or imprisonment not exceeding one year. Marking articles as patented which are not so, is punished with a fine. At the publication of the invention, any one thinking he has a prior right, may enter an opposition, which is then examined in the presence of those concerned. Existing German patents may be transferred to the Empire, but cannot be prolonged.

Paris Cement White a Substitute for White Lead.

The best coating for painting has hitherto been white lead, the manufacture and use of which are so injurious to workmen that Mr. L. Henry, of Paris, has sought a product which, while rendering the same services as white lead, does not present the disadvantages mentioned, and he claims that he has not only attained that object but gone beyond it, as his product is superior to white lead, without taking into account that it is 50 per cent cheaper, and that with an equal weight he can cover one third more surface. All cements do not completely destroy humidity or damp, they only isolate it, and little by little the layer of paint is eaten away. The Paris cement white will be found of great service used as a cement, that is to say, applied upon the moist or damp parts as mastic, and the paint placed over it will always preserve its freshness, will not peel off, and there will be no blisters; this part will be as hard as stucco. When executing rich or costly works, it will only be necessary to use Mr. Henry's cement as mastic to obtain panels of a brilliant whiteness or marbled, as may be desired, and with a perfect polish. In order that the resistance of the composition may be understood, he gives a comparison. It is well known that when it is desired to remove paint from a sign-board, for example, the painter is obliged by means of a small apparatus to apply flame to the part first coated in order to remove the white lead; now, his composition resists this firing, thus proving its hardness, and it also resists potassium. The Paris cement white is manufactured like white lead with kneading machines; it is, therefore, delivered in a paste, and when to be used for painting it is dissolved in linseed oil, as is done with white lead; it consists of whitening or Spanish white, baryta, oil, water, and zinc. He does not give the proportions of each product, as they vary with the quality of the said products and their destined use, whether at a mastic cement, for painting, for preserving railway sleepers, for making troughs or tanks watertight, and the innumerable other purposes to which his composition made of the above-mentioned matters in various proportions may be applied. The invention will be of considerable im-

portance to mines producing barytes, as it will extend the market, whilst it will be of equal interest to consumers, since they can use the Paris cement white at a low price, instead of paying the price of white lead for a material a large proportion of which consists of baryta.

Two Great Crops.

The United States produced last year a cotton crop worth about \$250,000,000, and a corn crop worth about \$583,000,000. Of a total agricultural product of \$4,000,000,000 the corn crop forms the largest item, being largely more than double the value of the crop which used to be called the King of American commerce. The King has now laid aside his purple robe and crown of jewels and become a highly respectable citizen, who is well received everywhere, but the whole of his estate is far less than that of his plebeian neighbor, Indian Corn, who enters into the business of society in a wonderful variety of forms. His guests sit down to a homely bill of fare, offering hominy, griddle cakes, egg bread, roasting ears, pudding, Johnny cake, popcorn. He shows with pride his well-filled stockyards of corn-fed beefs and porkers, which supply the home and foreign markets with the finest meat in the world, from the sweet beefsteak to the fragrant sugar-cured ham, fit for the table of a king. He has immense factories employed making starch and syrup, consuming millions of bushels. He runs great distilleries, which send out alcohol enough to float a fleet of war vessels, furnishing material to the arts, revenue to the government, rascality to the whiskey rings, and themes to the temperance lecturers.

The developments and applications of the great Western crop being so much greater than the Southern crop, it is not strange that the former is the stronger of the two. The principal use of cotton is for clothing; and while it has an excellence for that purpose, there are many substitutes for it, and its extinction would be a serious but not an irreparable loss to commerce.

The extinction of the corn crop would not only take from commerce a merchandise of more than twice the value of the other, but it would revolutionize many departments of trade.—*Louisville Commercial.*

A Possible Utilization for the Tramp.

Since writing our recent article on "Sewage Irrigation on a Small Scale," it has occurred to us that the chief item of expense in this most advantageous utilization of waste, namely, cost of labor of digging trenches, laying drain pipes, pumping, etc., might be materially compensated for by compelling tramps to do the work. It is a fact that the number of these vagrants is increasing, while society still stands puzzled before the problem of how to protect itself against them. Putting aside the actual depredations committed, their idleness alone renders them a dead weight upon the producing classes; and it therefore logically follows that no remedy which does not compel these vagrants to contribute their quota of useful effort toward the general welfare can ever reach the root of the evil. It is universally conceded that work is the punishment most dreaded by the tramp. Make it hard work, such as is involved in digging and pipe laying, and he will fear it the more. If, therefore, a village or town, desiring to test the profitability of sewage irrigation, should, whenever a tramp comes within jurisdictional limits, arrest him under a vagrant act, and compel him to labor for so many days, it would probably be found that the necessary irrigation works could then be cheaply constructed, or the other much to be desired result, of suppressing the tramp nuisance in the vicinity, attained.

Zigzag Sparks.

With a view to finding the cause of the peculiar zigzag form taken commonly by electric sparks, especially those of the Holtz machine, in air, Professor Tait, of Edinburgh, has recently had a number of photographs of such sparks prepared. These sparks were produced partly in ordinary air, partly in the free air one or two feet above the flame of a strong Bunsen burner, partly in a wide glass tube, into which air was passed through a long iron tube, heated to a dark red glow. The general result of the examination is that the zigzag form depends on something which heat is capable of removing from the air. This is, therefore, not water vapor, nor is it very small drops of water, for even falling water drops were inactive, except that they produced simply an interruption in the photographed sparks. It is probably, the author thinks, organic substances which, as Schiller and Pasteur have shown, would be kept away from the apparatus by a cotton stopper as well as by direct combustion.

Fletcher Harper.

Mr. Fletcher Harper, the surviving member of the original firm of Harper & Brothers, one of the largest publishing houses in the country, recently died in this city at the age of 71 years. Mr. Harper began work as an apprentice to his elder brothers; and when 19 years old, having become proficient in his trade, he was admitted into partnership with them. It was through his enterprise that the several periodicals now published by the firm were started; and until his virtual retirement from active business, two years ago, they were the objects of his constant care. He was a man of great executive ability, and of superior business capacity; in brief, one of those upright, intelligent, industrious citizens, whom every one respected, whose death is a loss to the community, and whose life was an exemplification of the rewards which justly fall to honest labor and sterling worth.

The Value of Small Inventions.

An excellent exemplification of the large returns which a small invention may often bring to its fortunate originator is found in the experience of Mr. Charles W. Cahoon, who recently died at Portland, Me. Mr. Cahoon possessed much inventive ability, besides that quality of persistent determination to succeed which usually characterizes the successful inventor. It is said that he realized sixty thousand dollars out of a little lamp burner, which had an appliance for lifting the chimney so that the wick could be reached for lighting or the mouth of the lamp for filling. This saved the frequent removal of the chimney while hot, and so doubtless prevented many fingers from being burned and many chimneys from being broken. Simple as was this device, Mr. Cahoon studied hard over it, and nearly lost his eyesight by persistent watching of the lamp flame under different conditions. It was the first invention of the kind patented (February, 1861), and infringers were plenty, but Mr. Cahoon protected his rights manfully and triumphed in the end. It is to be regretted that he could not have lived longer to have enjoyed the fruits of his strivings.

NEW BOOKS AND PUBLICATIONS.

BLUE AND RED LIGHT. By S. P. Hancock, M.D., Philadelphia, Pa.: T. M. Stoddard & Co., 723 Chestnut street.

This appears to be an attempt to galvanize new life into the moribund blue glass mania, through the production of some alleged benefits to invalids, supposed, this time, to be derived from red glass. A sense of duty to our readers has impelled us to devote some utterly wasted time to the examination of this work, which we now consign to the waste basket with the conviction that it contains more profound bosh than it has ever been our misfortune to find in so few pages—Pleasanton's book not excepted.

DIGEST OF COTTON BALE TIES. By Messrs. L. W. Jinsbaugh and T. C. Tipton. Price \$10. Published by the authors.

This is another one of those very valuable digests of special classes of inventions, several of which works have already been prepared by gentlemen connected, as are the present authors, with the United States Patent Office. We have no doubt but that this volume will prove exceedingly useful to inventors, manufacturers, and patent experts interested in its subject-matter. It is admirably compiled, and all the drawings are given complete, on a reduced scale. We should like to see more digests of this kind appear, one for instance on chains, another on cultivators, and another on beehives. The railroad people have been asking for just such a work on car couplers for a long time.

ANNUAL RECORD OF SCIENCE AND INDUSTRY FOR 1876. Edited by Spencer F. Baird. Price \$2. New York city: Harper & Bros., Franklin square.

This volume purports to be a complete history of the progress of science and industry for the past year. It consists, first, of a series of summarized reviews by Professor Barker, Dr. Dana, Professor Holden, and others, and, second, of a compilation of receipts mostly from technical periodicals.

DECISIONS OF THE COURTS.

Supreme Court of the United States.

PATENT FLOUR PROCESS.—WILLIAM F. COCHRANE, WILLIAM WARDER, RODNEY MASON, W. S. COX, et al., APPELLANTS, vs. JOSIAH W. DEENER, GEORGE W. CISELL, JAMES H. WELCH, et al.

[Appeal from the Supreme Court of the District of Columbia.—Decided October term, 1876.]

The powers of the supreme court of the District of Columbia, in patent cases, are the same as those of the circuit courts of the United States. Upon a bill in equity for the infringement of a patent, it is a matter of discretion, and not of jurisdiction, whether a case shall be first tried at law; and in this matter, the courts of the United States, sitting as courts of equity in patent cases, are much less disposed than the English courts are to send parties to a jury before assuming to decide upon the merits.

The jurisdiction of the circuit courts in cases arising under the patent and copyright laws is not changed by the Revised Statutes, and consequently the original cognizance of the circuit courts sitting as courts of equity in patent cases is retained.

Where it is discretionary with a court of equity whether it will first send a case to be tried at law, and it exercises its discretion to decide the case upon its merits without the aid of a jury of any sort, such action is not a ground of appeal.

But if the appellate court were convinced that the case was not properly decided, and could not be properly decided without such a reference, it might, in the exercise of its own discretion, remand it to the court below for that purpose.

It does not detract from the validity of a patent that the inventions of others are made use of in carrying out the patented invention. One invention may include within it many others, and patents for each and all be valid at the same time, but in such case each inventor would be precluded from using the inventions made and patented prior to his own, except by license from the owners thereof.

A process is a mode of treatment of certain materials to produce a given result, an act, or a series of acts, performed upon the subject-matter to be transformed or reduced to a different state or thing, and if new and useful it is patentable.

The patentability of a process is entirely independent of the instrumentalities employed, and it is immaterial whether or not the machinery pointed out as suitable to perform the process be either new or patentable.

The process requires that certain things should be done with certain substances and in a certain order; but the tools to be used in doing this may be of secondary consequence.

In the language of the patent law a process is an art. One device may be the equivalent of another in the general combination with other elements, and yet, when taken by themselves as separate pieces of machinery, they may not be the same, and the use of one not the infringement of a patent for the other.

While the parts of machinery which go to make up a combination could not when separately considered be regarded as identical or conflicting with those described in a patent, yet having the same purpose in the combination, and effecting that purpose in substantially the same manner, they are the equivalents of each other in that regard.

A foreign patent in order to invalidate an American patent must antedate the invention patented.

Mr. Justice Bradley delivered the opinion of the court: This is a suit in equity, instituted in the supreme court of the District of Columbia for injunction and relief against alleged infringement of various patents belonging to the complainants. The bill was dismissed, and the complainants have appealed.

The patents sued on are six in number, originally five granted to the appellant Cochrane on the 13th of January, 1863, and numbered respectively 37,317, 37,318, 37,319, 37,320, and 37,321. They all related to an improved method of bolting flour, the first being for the general process, and the others for improvements in the different parts of the machinery rendered necessary in carrying on the process. Three of the original patents, Nos. 37,317, 37,318, and 37,321, were surrendered, and reissues taken in 1874, which reissues were numbered 5,841, 6,029, and 6,030, the first being for the process, and the other two for portions of the machinery. Reissue 6,029, being in place of the original patent numbered 37,321, was also subsequently surrendered, and two new reissued patents substituted therefor, numbered 6,594 and 6,595.

The case has been mainly argued on the question of infringement, the defendants using a bolting apparatus constructed according to letters patent issued to Edward P. Welch, in April, 1873, for improvements upon machines patented to Jesse B. Wheeler and Ransom S. Reynolds, which, as well as the process employed, they contend, are radically different from the apparatus and process of Cochrane.

A preliminary question is raised with regard to the jurisdiction of the court below to hear the case on a bill in equity, before a determination of the rights of the parties in an action at law.

The powers of the supreme court of the District of Columbia, in patent cases, are the same as those of the circuit courts of the United States. (See Revised Statutes relating to the District of Columbia, sections 760, 764.)

The principal patent sued on in this case was granted on the 21st of April,

1874, being a reissue of a patent granted to William F. Cochrane on the 6th of January, 1863. The original patent was numbered 37,317, and the reissue 5,841. The alleged invention is for a process in manufacturing flour. The patentee in his specification says:

"The object of my invention was to increase the production of the best quality of flour; and my improvement consisted in separating from the meal first the superfine flour, and then the pulverulent impurities mingled with the flour-producing portions of the middlings meal, so as to make 'white' or 'purified' middlings, which, when reground and rebolted, would yield pure white flour, which, when added to the superfine, would improve the quality of the flour resulting from their union, instead of deteriorating its quality, as had heretofore been the case when the middlings were mingled with the superfine."

The process employed for producing the result here indicated is then described. It consists in passing the ground meal through a series of bolting reels clothed with cloth of progressively finer meshes, which pass the superfine flour and retard the escape of the finer and lighter impurities; and, at the same time, subjecting the meal to blasts or currents of air introduced by hollow perforated shafts furnished with pipes so disposed that the force of the blast may act close to the surface of the bolting cloth; the bolting chest having an opening at the top for the escape of the air, and of the finer and lighter particles therewith, through a chamber where the particles are arrested, while the flour and sides of each compartment of the chest are made close so as to prevent the escape of the air in any other direction than through the said opening. By this means the superfine flour is separated, and the fine and light specks and impurities, which ordinarily adhere to the middlings and degrade the flour produced therefrom, are got rid of, and when the middlings are now separated from the other portions of the meal, they are white and clean, and capable of being reground and rebolted, so as to produce superfine flour equal in quality, and even superior to the first installment.

This is the process described; but the patentee claims that it is not limited to any special arrangement of machinery. He admits the prior use of currents of air in the interior of the reels, introduced by means of hollow perforated shafts, for the purpose of keeping back the speck and increasing the quantity of superfine flour; but not for purifying the middlings preparatory to regrounding. His improvement, therefore, does not consist in using drafts and currents of air, but in the process as a whole, comprising the application of the blast, and the carrying off of the fine impurities, whereby the middlings are purified preparatory to regrounding after being separated from the other parts.

The defendants deny that they use this process. They purify the middlings of the flour, as before stated, by means of machines constructed according to letters patent issued to Edward P. Welch, in April, 1873, for improvements upon machines patented to Jesse B. Wheeler and Ransom S. Reynolds.

In this process reels are not used for purifying the middlings, but a flat and slightly inclined vibrating screen or sieve is used for the purpose, over which the ground meal is passed, and while passing is subjected to currents of air blown through a series of pipes situated close underneath the screen, which currents pass up through the screen and through an opening at the top of the chest into a chamber, carrying with them the finer and lighter impurities, whereby the middlings are rendered clean and white, and capable of being reground into superfine flour. The bolting chest is made tight and close on all sides except the opening at the top, so that the currents of air may be forced to escape by that exit.

Now, except in the use of a flat sieve or screen in place of reels, it is difficult to see any substantial difference between these two methods. The defendants use, in addition, brushes which revolve on the under side of the screen, so as to keep the meshes thereof constantly clean and free; but this is merely an addition, which does not affect the identity of the processes in other particulars. We have substantially the same method of cleaning the middlings preparatory to regrounding by means of currents of air passed through them while being bolted, and while being confined in a close chest or chamber, said chamber having an opening above for the escape of said currents of air and the impurities with which they become loaded. The middlings being thus purified are reground and rebolted, producing a superfine flour of superior grade, a new, useful, and highly valuable result.

The use of a flat screen instead of a revolving reel for bolting and cleaning the middlings is a mere matter of form. It may be an improved form, and, perhaps, patentable as an improvement. But it is at most an improvement.

The forcing of the air currents upward through the screen and film of meal carried on it and against the downward fall of the meal, instead of forcing them through the bolting cloth in the same direction with the meal, is also a mere matter of form, and does not belong to the substance of the process. The substantial operation of the currents of air in both cases is to take up the light impurities and bear them away on the aggregate current through the open due and thus to separate them from the middlings. This, too, may be an improvement on Cochrane's method, but it is only an improvement.

The defendants admit that the process has produced a revolution in the manufacture of flour; but they attribute that revolution to their improvements. It may be, as they say, that it is greatly due to these. But it cannot be seriously denied that Cochrane's invention lies at the bottom of these improvements, is involved in them, and was itself capable of beneficial use, and was put to such use. It had all the elements and circumstances necessary for sustaining the patent, and cannot be appropriated by the defendant, even though supplemented by, and enveloped in, very important and material improvements of their own.

We do not perceive that the patent of Cogswell and McKiernan, if valid at all as against Cochrane (a point which will be more fully considered hereafter), affects the question in the least. That patent is not at all for the patent which Cochrane claims. If valid, and if, in using his process, Cochrane is obliged to use any device secured to Cogswell and McKiernan, it does not detract in the slightest degree from his own patent. One invention may include within it many others, and each and all may be valid at the same time. This only consequence follows, that each inventor is precluded from using inventions made and patented prior to his own except by license from the owners thereof. His invention and his patent are equally entitled to protection from infringement as if they were independent of any connection with them.

That a process may be patentable irrespective of the particular form of the instrumentalities used, cannot be disputed. If one of the steps of a process be that a certain substance is to be reduced to a powder, it may not be at all material what instrument or machinery is used to effect that object, whether a hammer, a pestle and mortar, or a mill. Either may be pointed out, but if the patent is not confined to that particular tool or machine, the use of the others would be an infringement, the general process being the same. A process is a mode of treatment of certain materials to produce a given result. It is an act, or a series of acts, performed upon the subject matter to be transformed and reduced to a different state or thing. If new and useful it is just as patentable as is a piece of machinery. In the language of the patent law, it is an art. The machinery pointed out as suitable to perform the process may or may not be new or patentable, while the process itself may be altogether new, and produce an entirely new result. The process requires that certain things should be done with certain substances and in a certain order; but the tools to be used in doing this may be of secondary consequence.

The machine patents come next to be considered. As to No. 6,030, which is a reissue of the original patent No. 37,318, the defendants clearly infringe, at least the last claim, which is in these words:

"In combination with the screen incased in a chest, the perforated blast pipe and the suction pipe, arranged to operate on opposite sides of the screen, substantially as set forth."

As to the patent next in order, namely, the original patent No. 37,319, which relates specially to the use of what the patentee calls the pump for introducing the meal into the chest and reels, while the valve arrangement used by the defendants may be an equivalent in the general combination with the said pump described by Cochrane, yet, taken by themselves, as separate pieces of machinery, they are not the same, and the use of the one is not an infringement of a patent for the other. (Curtis, sec. 332; Foster vs. Moore, 1 Curtis, C.C.R., 279.) Nor can we perceive that the defendants infringe the next patent, No. 37,320, which is for certain combinations of machinery, including the bolting reels, dead air chambers therein, slotted shaft, and reciprocating board for discharging the meal, etc., which it is unnecessary to describe more particularly.

The two remaining patents, No. 6,594 and 6,595, being reissues of original patent No. 37,321, are for combinations of essential parts of the machinery required for bolting flour and purifying the middlings according to the general process described in the first patent. The principal claim of the original patent was for the condensing or collecting chamber, through which the currents of air on leaving the bolting chest make their escape, and where they leave the fine particles with which they become loaded. This claim, it is said, was found to be too broad, inasmuch as a collecting chamber somewhat similar had been used in another connection, though not in the combinations presented in Cochrane's bolting process. The original patent, therefore, was surrendered, and the two patents now under consideration were issued in place thereof, claiming the use of the collecting chamber in combination with the various material parts of the bolting apparatus. The reissue, No. 6,594, contains three claims, and No. 6,595, one claim.

The first claim of reissue No. 6,594 is for the collecting chamber (used for the purpose aforesaid) in combination with the bolter, air pipes, and valves for feeding and delivering the meal without allowing the air to pass therewith. Now, although the defendants use a flat bolter instead of a reel, and use different kinds of valves for feeding and delivering the meal without allowing the air to pass, yet they employ the combination of devices described in this claim. They use the collecting chamber for the same purpose as that pointed out in the patent, and use it in connection with a bolter, air pipes, and valves for feeding and delivering the meal without allowing the air to pass therewith, each effecting the same separate purpose, and all combined effecting the same general purpose, which the like parts are intended to accomplish in Cochrane's bolting apparatus. Though some of the corresponding parts of the machinery, designated in this combination, are not the same in point of form in the two bolting apparatuses, and, separately considered, could not be regarded as identical

or conflicting, yet having the same purpose in the combination, and effecting that purpose in substantially the same manner, they are the equivalents of each other in that regard. The claim of the patent is not confined to any particular form of apparatus, but (in regard to the valves for example) embraces generally any valves for feeding and delivering the meal without allowing the air to pass through. We are of opinion, therefore, that the combination here claimed is infringed by the apparatus used by the defendants.

It is unnecessary to make a separate examination of the other claims embraced in the two patents under consideration. They are all susceptible of the same observations which we have made with regard to the first claim. In our opinion the defendants do infringe them.

But a question is raised with regard to Cochrane's priority of invention. A patent was granted on the 13th of June, 1860, to Mortimer C. Cogswell and John McKiernan for improvements in ventilating bolting chests, which, it is contended, antedates and nullifies Cochrane's apparatus as patented to him in the original patent 37,321, and in the two reissues thereof before mentioned. This patent (of Cogswell and McKiernan) we have examined and find that it does contain five of the elements embraced in these reissues, namely (besides the bolting chest and bolter which are always used), it contains the perforated air pipe extending inside of the bolting reel, the fan for producing a blast of air therein, and a collecting chamber for arresting the flour carried off by the blast. The purpose was simply to cool the meal and keep the bolting cloth dry. The flour which collected in the chamber was returned to the chest. The parts contained in this apparatus are those which are patented in combination in Cochrane's reissue 6,595, which was separated. It is said, from reissue 6,594 on account of this patent of Cogswell and McKiernan. The combinations patented in reissue 6,594 embrace other parts not contained in Cogswell and McKiernan's patent, and the defendants contend that this reissue is void as not being sustained by the original patent 37,321.

The latter position we think is untenable. Cochrane's apparatus, as exhibited in his model, and described in his original patent, and in the series of patents taken out at the same time, all having relation to the same general process, and referred to in patent 37,321, contained all the parts which go to make the combination claimed in reissue No. 6,594. We see no reason, therefore, why such reissue was not properly granted to him by the Patent Office—the claim being, in fact, a much narrower one than that of the original patent.

The same observations apply to reissue No. 6,596. But, as to that, as before stated, the particular elements of the combination claimed in it are found in Cogswell and McKiernan's machine; and if this is entitled to the precedence over Cochrane's, reissue No. 6,596 is void. He contends that it is not entitled to such precedence; but that, in fact, Cogswell and McKiernan surreptitiously obtained a patent for his invention. We have examined the evidence relating to this matter and are satisfied that the improvement claimed by Cochrane was his invention; that Cogswell and McKiernan obtained their knowledge of it from him; and that there is nothing connected with their patent which ought to invalidate the reissued patent in question.

A French patent dated 27th of September, 1860, granted to one Perigault, is also referred to as anticipating the combinations in these patents. But it being shown that Cochrane's invention was actually made before that date, the point was not pressed in the argument. By the act of 1870 a foreign patent, in order to invalidate an American patent, must antedate the invention patented.

Our conclusion is that the patent for the process being reissue No. 5,841, and the several reissued patents for combinations of mechanical devices, numbered respectively 6,030, 6,594, and 6,595, are valid patents, and are infringed by the defendants; and that the other two patents named in the bill of complaint, numbered respectively 37,319 and 37,320, are not infringed by the defendants.

The decree of the court below is, therefore, reversed, and the cause is remanded with directions to enter a decree for the complainants and to proceed therein in conformity with this opinion.

Mr. Justice Clifford, dissenting.

I dissent from the opinion and judgment of the court in this case, for the following reasons:

1. Because the mechanical means employed by the respondents to effect the result are substantially different from those described in the complainant's patent.
2. Because the process employed by the respondents to manufacture the described product is materially and substantially different from the patented process employed by the complainants.
3. Because the respondents do not infringe the combination of mechanism patented and employed by the complainants. (Prouty vs. Ruggles, 13 Pet. 341; Vance vs. Campbell, 1 Black, 438; Gill vs. Wells, 22 Wall., 26.)
4. Because the respondents do not infringe the process patented by the complainants, the rule being that a process, like a combination, is an entirety, and that the charge of infringement in such a case is not made out unless it is alleged and proved that the entire process is employed by the respondents. (Howe vs. Abbott, 2 Story C. C., 194; Gould vs. Rees, 15 Wall, 193.)

I concur in this dissent.—Strong, J.

(E. Mason and Chas. F. Blake, for complainants.

A. L. Merriam and Howard C. Cady, for respondents.)

United States Circuit Court—District of Maryland.

INJUNCTION AGAINST THREATENING PATENTEES.—JOHN C. BIRDELL vs. THE HAGERSTOWN AGRICULTURAL IMPLEMENT COMPANY.

[In equity.—Before Bond, C. J., and Giles, J.—Decided March, 1877.]

Motion to enjoin complainants from bringing suits against the defendants' vendees.

In this case, an injunction had been issued restraining defendants from infringing on the reissued patent granted complainant May 18, 1858; reissued April 8, 1862; for an improvement in machinery for hulling and thrashing clover. The defendants afterwards changed the construction of their machine and proceeded to sell clover hullers of the changed construction. On a motion made by complainant to commit them for contempt of court, for violating the injunction issued against them, by selling machines of this changed construction, the court held that, on the showing made, the machines were substantially different from Birdsell's patented machine; and, therefore, dismissed the motion. (See Official Gazette, March 13, 1877.) Thereafter complainant notified several of the vendees of defendants—some of whom were using the original machine that had been enjoined, and some of whom were using the machine as it had been changed—that, unless settlement were made with him forthwith, suit would be brought against them. Defendants, thereupon, moved upon a cross petition filed in the original case, for an injunction to issue against the complainant, restraining him, while the original suit was still pending against them, under which damages and profits could be collected for all the machines that they made and sold, from bringing any suit, or threatening to bring any suit against any vendees of theirs, based upon a user of a machine that might become subject of account in the original case.

Counsel for defendants, seeking the injunction against complainant, based their motion upon the general equity jurisdiction of the court; that, inasmuch as complainant had submitted himself to the jurisdiction of the court to obtain relief against the defendants, he was also subject to the order of the court in relation to any matter relating to the granting of that relief; that the defendants were thoroughly responsible; and that upon the original suit being carried on to completion, if recovery was made, the complainant would recover in that suit all the profits that defendants had obtained from the wrongful manufacture, and the damages that he had suffered by reason of the wrongful manufacture, and that complainant would, therefore, be put in the same position as if he had originally sold all the machines. That, this being the case, he ought not to be allowed to interfere with the vendees of defendants while the suit against them was pending. In support of their position they cited the decrees of Judge Drummond in the case of Isaac W. Barnum vs. Herman B. Goodrich, entered in United States Circuit Court for the northern district of Illinois, July 2, 1873, wherein the complainant having brought suit against the defendant and obtained an order for defendant to keep an account of the sale of the devices alleged to be an infringement, was enjoined from prosecuting suits, already begun by him in other circuits, against the defendants' vendees, and from bringing any further suits against defendants' vendees; also the decree entered by the Hon. H. H. Emmons, United States Circuit Judge, and Hon. P. B. Swing, United States District Judge, in the circuit court of the United States for the southern district of Ohio, in the case of Ezekiah B. Smith vs. J. A. Fay & Co., restraining the complainant from bringing suit against the defendants' vendees. In other circuits, the complainant in this case having obtained an interlocutory decree and a reference to the master, and the suit being, at that time, pending before master on the question of the account.

The defendants relied upon the fact that the complainant was a resident of Indiana, and not before the court, and had sought the jurisdiction of the court for the purpose of bringing the suit, and for no other purpose. He was not, therefore, subject to any order upon him; that the court could not enforce an order if it made one, and it would not do an idle thing.

The respondents asking the order were represented by Hatch & Parkinson, of Cincinnati; the complainant by M. D. Leggett & Co., of Cleveland. The court did not deliver a written opinion; but, having considered the matter, entered the following order:

Bond, J.:

This cause coming on to be heard upon the petition of the defendant herein for an injunction to issue against the complainant to restrain him from commencing or prosecuting, or threatening to prosecute, any suits against any of the vendees, or vendees of vendees of defendant, for the use or sale of clover hullers manufactured by the defendant at Hagerstown, and sold by them or their agents, and it appearing to the court that the complainant has been threatening to bring suits against said vendees while suit is still pending by him in this court against the defendant, the manufacturer, and the case having been fully argued by the counsel for the respective parties, the court doth order: That said John C. Birdsell, the complainant herein, be restrained and barred from commencing or prosecuting,

DECREES.

or threatening to commence or prosecute, any suit against any vendee of this defendant, or any vendee of a vendee of this defendant herein, for this alleged infringement of the released letters patent involved in this case, and on which this case is brought, based upon a use or sale by said vendee of any clover machine purchased of this defendant;

Provided said defendant shall within thirty days file a bond in this case in the sum of five thousand dollars, with securities to be approved by the court, for the payment of any damages that may be adjudged against the defendant in the above entitled suit, and that defendant shall file in this court a sworn monthly statement of the number of clover machines herein-after made and sold by them.

Inventions Patented in England by Americans.

From May 8 to May 14, 1877, inclusive.

BUTTON HOLE SEWER.—W. Randel et al., Troy, N. Y.

CAR FARE REGISTER.—H. E. Towle, New York city.

CLEANING GUNS, ETC.—H. L. Budd, New York city.

GLOVE STRETCHER.—J. Herts, New York city.

LAMP BURNER.—Benedict & Burnham Co., Waterbury, Conn.

MOTIVE POWER FOR VESSELS.—T. S. Seabury, New York city.

PAINT OIL.—G. Walker et al., Chicago, Ill.

ROLLING LEATHER, ETC.—A. F. Stowe, Massachusetts.

SCREW, ETC.—H. A. Harvey, Orange, N. J.

SHOE-FASTENING.—F. G. Farnham, Hawley, Pa.

SPEED GOVERNOR, ETC.—G. Westinghouse, Jr. (of Pittsburgh, Pa.), Liverpool, England.

WINDING REEL.—W. Grover et al., Holyoke, Mass.

WOOD PAVEMENT.—F. C. Taylor, Chicago, Ill.

Recent American and Foreign Patents.

Notice to Patentees.

Inventors who are desirous of disposing of their patents would find it greatly to their advantage to have them illustrated in the SCIENTIFIC AMERICAN. We are prepared to get up first-class wood engravings of inventions of merit, and publish them in the SCIENTIFIC AMERICAN on very reasonable terms.

We shall be pleased to make estimates as to cost of engravings on receipt of photographs, sketches, or copies of patents. After publication, the cuts become the property of the person ordering them, and will be found of value for circulars and for publication in other papers.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED BLACKSMITHS' TONGS.

James H. Gregory, Columbia, Tenn.—These tongs are so constructed that they may be used for holding two pieces of iron together, either straight or at any desired angle, for welding. They may be used as a clamp, for holding the two ends of a tire with any desired lap, for holding a piece or splice to be inserted in a tire, or for holding various kinds of blades and cutters to be ground, and for other similar purposes.

IMPROVED MILL SPINDLE BUSH.

Harvey T. Ashworth, Chatham, Va.—This consists of a bush for the eye of the bedstone, which is made of a block of hard wood or metal, and recessed for the reception of the cushioned journal blocks or followers. The latter are recessed near the upper end, and filled with a suitable lubricating mixture. The top of the journal block is tightly closed by a rubber cap fitting tightly around the spindle.

IMPROVED RAILROAD SIGNAL.

Charles Halse and Frank Halse, Atlanta, Ill.—This is an improved device to enable an approaching train to be signaled from the office, so that there may be no delay in making the signals when promptness is necessary. Wires and levers are so arranged that a lantern can be turned through a quarter of a revolution, so as to show a white or a colored light, as may be necessary.

IMPROVED CAR COUPLING.

Gardner D. Lease, Jeffersonville, Va.—This coupling couples in automatic manner by the entrance of the link. It consists of a longitudinally slotted drawhead with centrally pivoted and weighted lever bar, and curved or hook-shaped coupling pin, that is pivoted to the rear end of the lever bar, and dropped with the same by the action of the coupling link into a top recess and bottom pinhole of the drawhead, coupling thereby the link.

IMPROVED APPARATUS FOR CARRYING RAILROAD RAILS.

Andrew J. Gustin, St. Albans, Vt.—This is an improved apparatus by which the rails are taken up and conducted to the cooling bed, after having been passed through the bending rolls that impart the proper camber, so as to compensate for the unequal shrinkage of the rail while becoming cold. The device may also be used for moving the rails en masse from the position where they are left to cool to the end where they are taken off to the straightening machine. The invention consists of a bed frame with lateral chains and rail carrying shoes, the chains and shoes being guided in grooved rails, flush with the bearing rails of the bed, and the chains automatically adjusted to expansion and contraction by movable and weighted pulley bearings; also, two long screws with suitable bearings at the ends, and dogs shaped to fit the screws, and guided in grooves to hold them in position. The dogs are provided with trip latches, and the screws are connected with reversible driving shaft with gears.

IMPROVED PLATE PRINTING PRESS.

Horatio W. Browne, Philadelphia, Pa.—This consists in a novel device for moving the bed under the impression roll, the object being to increase the rapidity with which the impressions may be taken from the plates.

IMPROVED ROCK-DRILLING MACHINE.

Aaron J. Mershon, Warsaw, Ind.—This invention consists in the combination of a disk secured to a shaft, and having an arc-shaped slot, in the end of which is journaled a concave roller, with an arm placed loosely on the drill rod, and extending through the slot of the disk, so as to be engaged by the concave roller as the disk is revolved. It was fully described and illustrated on page 358, current volume.

IMPROVED REVOLVING ORE ROASTERS.

John Howell, Benton, Cal.—This is an improved rotary tubular furnace for chloridizing silver ores and desulfurizing copper, gold, tin, and zinc ores. There is a revolving tube with a furnace at the receiving end, having the chambers, and a furnace at the lower end having a pit, into which the ore is discharged after treatment.

IMPROVED IRON MOULDING.

Joseph Hursh, New York city.—To the pattern is secured a male screw, projecting sufficiently to allow a key to be firmly screwed upon it. The screw is covered with a small slightly tapering cap, while the sand is being packed upon it, and which protects the threads of the screw from being filled with sand. When the cope is raised from the pattern the cap is either left upon the screw or taken off with the sand, and can then be drawn, in either case leaving a smooth hole in the sand, which can be easily filled. By this construction no time need be lost in freeing the screw threads from sand, and the same will not be worn by the latter.

IMPROVED SQUARE.

Charles A. Schrier, Holyoke, Mass.—The object is to so improve the universal square in general use that a line may be drawn along the whole length of the tongue or blade without removing the square from the roll or other object. To this end the square has a crossbar with curved or raised portion above the central edge of the tongue to admit the continuation of the line along the same.

IMPROVED GRAIN CRUSHER.

Joseph Reid and Robert Reid, Philadelphia, Pa.—This is a machine for crushing and pulverizing grain. Grain to be crushed is delivered to a hopper, and the machine being in motion, it is caused by vibratory motion to flow rapidly down a chute to the rolls by which it is crushed and delivered to another chute, through which it passes to a suitable receptacle.

IMPROVED PIPE TONGS.

Christian States and Harry I. Cook, Topeka, Kan.—This combines the advantages of a pipe tong, wrench, and screwdriver. It consists of a double jaw, with curved end and notches, in connection with a single jaw and lever sliding in the double jaw, and having projecting pivot pins for entering into the notches. This invention was illustrated and described on page 310, current volume.

NEW HOUSEHOLD INVENTIONS.

IMPROVED PICTURE FRAME.

Samuel Sargeant, Brooklyn, N. Y.—This consists in a frame formed of metal tubes, halved to each other, and secured to a back frame or board by screws passing through said back frame or board, through the inner sides of the said tubes, and screwing into pieces of wood placed within said tubes.

IMPROVED BOOTJACK.

John Niver, Sherman, N. Y.—This is an improved bootjack designed to be attached to a wall, and to be turned up against the wall when not in use.

IMPROVED LAMP BURNER.

Jonas Rasch, Christiania, Norway.—This is an improved round burner for petroleum lamps, on which the chimney may be adjusted to different heights, for the purpose of obtaining a more perfect combustion and better light. The chimney is quickly set at the proper elevation above the aperture of the burner by a simple mechanism.

IMPROVED SHIRT-DRYING APPARATUS.

John McCartan, New York city.—This is an improved apparatus for drying starched shirts, formed of a hollow metal plate, made of such a shape and size as to be passed into a shirt, which is spread out smoothly upon it. Hollow metal cylinders are made of a proper size for the cuffs of the shirt to be spread out upon them. The hollow plate and cylinders are each provided with a steam inlet pipe, through which steam is introduced from a boiler or other steam generator, and a steam outlet pipe, to enable the said plate to be brought to and kept at a suitable temperature to dry the shirt and cuffs quickly.

NEW MISCELLANEOUS INVENTIONS.

IMPROVED COMBINED LETTER SHEET AND ENVELOPE.

Leo Ehrlich, St. Louis, Mo.—This invention consists of a sheet of suitable size having sealing flaps that extend at one corner along a portion of the sides, so as to close in the nature of an envelope when the sheet is folded up.

IMPROVED PROCESS OF FINISHING CARDBOARD FOR PERFORATING.

Bernard Dreyfuss and Samuel Sachs, New York city.—This consists in coating a suitable quality of cardboard with a mixture of powdered metallic zinc, glue, starch, and wax. The board is given a bright silvery surface, which is very hard, and well prepared for perforation in the usual way.

IMPROVED PHOTOGRAPHIC PRINTING APPARATUS.

Oliver Sarony, Scarborough, England.—The object of this invention is to obtain by two successive exposures the title, tint, or fancy border on the same negative with the picture, so as to dispense with the use of registering presses and registering tinting presses hitherto employed, and therefore with the second printing. A print having the appearance of what is known as a chromotype may be thus produced in the ordinary printing frame at one printing instead of two, as at present.

IMPROVED SLEEVE BUTTON AND STUD.

Alexander Goll, Frankfurt-on-the-Main, Prussia, Germany.—This sleeve button or stud has an elastic piece of metal, double or open slotted, and attached to a flat pivot at the end of its bent shank.

IMPROVED APPARATUS FOR WEIGHING LIQUIDS.

John G. Valentine, Florence, Mass., assignor to himself and Edward Valentine, of same place.—This is a receptacle for liquids, that is suspended from a scale lever pivoted in a frame, in the handle of which is pivoted a spring connected by a scale with the said lever, for indicating the weight of liquids contained by the receptacle.

IMPROVED COFFEE ROASTER.

John A. Caldwell and Adolph F. Pleitz, Brownsville, Tenn.—This improved coffee roaster is so constructed as to keep the coffee constantly turning over, so that it cannot slide upon the vessel and burn.

IMPROVED SUSPENDER.

Leonard V. Richmond, Sand Lake, N. Y.—The suspenders are so made that whatever position the body of the wearer may take, the tautness of some of the straps will take up the slack of the others, so that there will be no perceptible strain upon any of the buttons.

IMPROVED GALLEY SUPPORT.

Peter A. Kelly, Baltimore, Md.—This is a support for printers' galleys, which may be readily attached to the case, and which may be folded out of the way when not in use. The device is put into position for use by placing hooks on the edge of the case, and unfolding the brackets so that they are at right angles to the frame.

IMPROVED BOX AND BOX HOLDER.

Joseph A. Cotten, Thomaston, Ga.—The object is to provide a means for handling boxes upon high shelves without the use of steps or necessity of climbing. The box has its end slotted and bent inwardly and supported by the strengthening band, the whole being adapted to engage with the grapple or lifter, which has a widened head for the purpose.

IMPROVED STRAP FASTENER.

Wesley Hyre, Collins, Ind.—This invention consists in a flat wedge-shaped case, and a wedge provided with the points combined with each other to adapt them for use for fastening a strap. In using the fastener, the strap is passed through the case. The wedge is then placed upon the strap, and the strap and wedge are drawn forward together into the case.

IMPROVED WATER CLOSET PROTECTOR.

Benjamin R. Brown, Petersburg, Va.—This consists in a sheet of paper provided with two circles or lines of punctures, forming between them a ring having an inwardly projecting narrow flap and an outwardly projecting wide flap.

IMPROVED SPRING FISH HOOK.

John O. King, Alhambra, Kan.—This invention relates to that class of fish hooks which are sprung when the fish tapers with the bait, so as to close and catch the same. It consists of fulcrumed grab hooks having outer claws and U-shaped ends back of the fulcrum, in connection with a sliding loop at the end of a coiled hook actuating spring, the hooks being opened by a swinging trip lever, connected by a link to the spring loop, and set to a fulcrumed latch of the sliding and guided bait hook.

IMPROVED INDICATOR.

George W. Daniels, Lexington, O.—This is an index for account books, by which the name may be more readily referred to than in the indices usually applied to such books. It consists in a polygonal drum that turns on a vertical axis, and is inclosed in a suitable casing, and arranged to receive upon each of its sides a division of the alphabet, consisting of one or more letters.

IMPROVED CIGAR.

James H. Campfield, M.D., Ottawa, Ill.—The object of this invention is to render the smoke of cigars made of tobacco less offensive and injurious. In the process of manufacture, a chamber or cavity is formed in each cigar and a piece of sponge or other suitable absorbent material, which has been saturated with a solution of tannic acid, is inserted therein for the purpose of extracting from the smoke drawn through the cigar the nicotine and empyreumatic oil, which are poisonous and inimical to health.

IMPROVED TOY SKATING RINK.

Sophie E. Bachmann, Tenafly, N. J.—The skating rink consists of a box having its top formed of paper or other thin material, representing ice, on which diminutive figures representing skaters, and weighted by means of iron shoes, are moved about by the attraction of a magnet held in the hand, and applied beneath the paper.

IMPROVED GRAIN-REDUCING APPARATUS.

Cyrus Bailey, Akron, O.—This consists of a perforated revolving cylinder or reel, that feeds the oats or other grain to fixed cutting knives, regulating the length of the projecting kernel portions by adjustable guard-plates. The holes through which the oats or other grain are dropped are straight at the end toward the knife, and inclined or countersunk at the other end to carry the grain into position for cutting.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED SASH FASTENER.

Joseph Hatzel, Spades, Ind.—This consists of a sash with sliding and spring-acted bolts entering between guide strips of the window casing and into sockets of the same, the sash bolts being secured into the different positions required for locking, guiding, or removing the sash, by being set into corresponding recesses of the face plates of the bolt sockets.

IMPROVED SASH FASTENER.

William Kemp, Jr., New York city.—This consists in the combination of a sliding bolt, placed in a suitable guide that is attached to the upper meeting rail of the lower sash, and provided with a spindle and slotted arm for moving the bolt; and two slotted bars, one of which is attached to a stile of the upper sash, and the other to the roller stile or jamb of the window. The object is to simultaneously lock both sashes by a single operation and by a single bolt.

IMPROVED SAW SET.

William H. Smerdon, and Baylies F. Phillips, Taunton, Mass.—This consists of an anvil with pivoted and spring-acted set piece, and a gauge and bevel plate, jointly adjustable, so that there may be simultaneous adjustment of gauge and bevel to the saw teeth.

IMPROVED HORSE DETACHER.

Moses Amidon and Edgar N. McKimm, Lathrop, Mo.—The object of this invention is to furnish whiffletrees so constructed that the traces may be instantly released and the horse allowed to go free should he become frightened or unmanageable from other cause.

IMPROVED SNOW GUARD FOR ROOFS.

George F. Folsom, Boston Highlands, Mass.—This consists of a right-angled or L-shaped strip of sheet metal that is folded to form a square face, a brace for holding the same, and wings which pass under the slate for supporting the brace. In addition to these features, the square face is slit up for a short distance each side of the brace to form prongs, that spring against the surface of the slate, and, in conjunction with the wings, clamp the slate, so that the guard will not slip from it. The object of the invention is to provide a snow guard for roofs that may at any time be attached to the same, and that will effectually prevent the snow from sliding bodily from the roof.

NEW AGRICULTURAL INVENTIONS.

IMPROVED BUTTER PAIL COVER.

Joseph G. Fisher, Grand Rapids, Mich.—A spring made of elastic wood crosses the center of a bar on the cover, and its ends project sufficiently to allow metal straps, attached to its said ends, and having elongated holes formed in their free ends, to be passed over the heads of small knobs attached to the sides of the pail, so that the cover may be held securely in place by the elasticity of the spring.

IMPROVED FLOW.

Anton Laner and Julius Hartmann, Louisville, Ky.—This is an improved center draft plow so constructed that there will be no friction upon the landside, and so as to enable the point to be made of steel.

IMPROVED COMBINED STALK CUTTER AND HAY RAKE.

William W. Fuller, Elmira, Ill.—This machine is so constructed that it may be readily adjusted for use as a stalk cutter or as a hay rake. The stalk cutter, the stalk adjuster, and the rake can be raised and lowered by operating a lever.

IMPROVED POWER CHURN.

William H. Sterns, Humboldt, Neb.—By turning the crank, the churn body will be carried around through the arc of a circle, which will throw the milk contained in said churn body into violent agitation, the ribs breaking up the circular currents that would otherwise be formed in the milk.

IMPROVED GATE.

Israel D. Jewett, St. Omer, Ind.—This invention is an improvement in the class of gates which are supported by parallel pivoted bars, and operated by levers, so that in being opened or closed they move in a vertical plane and in the arc of a circle. The improvement relates to the use of a horizontal bar or lever, to which the bars supporting the gate are pivoted, and whose function is to assist in maintaining the gate in a horizontal position.

IMPROVED CULTIVATOR.

Nathan T. Brewster and Abraham D. Neher, Roseville, Cal.—This invention consists in the particular arrangement of a double wrought iron frame combined with cultivator teeth, and separating blocks located between the parts of the frame, one set of which blocks in the front, and also in the rear, of the cultivator form bearings for wheeled axles through which the cultivator is raised for transportation or lowered for use; the particular arrangement of the cultivator being such as to impart to the same great strength and durability, and to permit the same to be readily taken to pieces and used independently of its wheels if desired.

IMPROVED BEE-HIVING APPARATUS.

Reuben B. Oldt, New Berlin, Pa.—This consists in a pivoted case containing two inclined planes that run downward from slots in the top of the casing over which the hives are placed. One of the inclined planes is pivoted, and is capable of moving upward when the shifting of the bees changes the center of gravity of the casing, so that it turns on its pivots. There is also a new arrangement of a mica trap door, which allows bees to escape from the hive from which they swarm, but does not permit them to re-enter.

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Notes & Queries

C. H. W. will find articles on the canal boatward in New York State on p. 81, vol. 30.—A. B. will find on pp. 235, 236, vol. 36, directions for coloring brickwork.—J. H. P. can use olive oil in combination with phosphorus in a glass tube. We cannot work out his problem for him.—W. E. N. will find directions for imitating black walnut on p. 90, vol. 32.—J. P. L. will find the dimensions and threads of gas pipe on p. 378, vol. 32.—J. B. B. will find a recipe for lacquer for brass on p. 116, vol. 33.—P. A. F. will find a recipe for a filling for safes on p. 75, vol. 32.—C. D. C. will find directions for polishing brass on p. 298, vol. 29.—J. K. will find directions for skeletonizing leaves on p. 155, vol. 31.—J. W. F. S. will find an article on the manufacture of postage stamps on pp. 208, 277, vol. 27.—G. W. A. should read our article, on p. 33, vol. 33, as to ascertaining the power of an engine.—J. W. P. will find something on the manufacture of starch on p. 154, vol. 30.—C. B. M. will find the proportions of a surface condenser on p. 306, vol. 32.—C. F. F. will find an explanation of the speeds of different parts of a wagon wheel on p. 208, vol. 31. The other question is too absurd to need reply.—E. K. E. will find a recipe for a durable paint for floors on p. 165, vol. 34.—W. M. will find directions for magnetizing steel on p. 37, vol. 31.—E. J. L. is informed that the relative power of different batteries is described on p. 26, vol. 26.—L. B. should read our articles, on pp. 325, 340, vol. 30, on granite and marbleized ware.—M. G. will find directions for melting vulcanized rubber on p. 119, vol. 28. To mend rubber boots, see p. 203, vol. 30.—A. R. will find the flying machine suggestions carefully discussed on p. 112, vol. 32.—H. B. K. will find that the ball dropped into a hole through the earth is dis-

cussed on pp. 138, 250, vol. 31.—D. H. will find directions for manufacturing corn starch on p. 154, vol. 30.—W. Z.'s query as to carrying a piece of timber is answered on p. 263, vol. 36.—D. K. H. will find on p. 156, vol. 31, directions for making rubber stamps.—W. B. P. cannot make better manifold transfer paper than is described on p. 278, vol. 28.—A. R. will find a recipe for hair dye on p. 230, vol. 35.—S. J. H. will find on p. 298, vol. 27, directions for preserving insects.—J. C. S. will find a description of a method of utilizing the motion of a ship to pump water from the hold on p. 13, vol. 26.—C. L. will find directions for making charcoal into blocks for filters on p. 206, vol. 32.—H. D. H. is informed that we do not know what he means by "enameling on pearl or ivory."—H. C. H. will find directions for waterproofing canvas on p. 347, vol. 31.—W. S. V. can enlarge his designs by using a pantograph. See p. 179, vol. 28.—Dr. J. Z. T. can make a good rubber cement by following the directions on p. 139, vol. 35. This also answers T. T., who asks for a cement with which to mend a rubber belt.—A. R. F. will find directions for making printers' rollers on p. 283, vol. 31.—W. W. M. will find directions for preserving eggs on p. 219, vol. 31.—E. A. W. will find an excellent recipe for hair wash on p. 138, vol. 33.—L. M. will find a recipe for a depilatory on p. 186, vol. 34.—R. T. P. is informed that no sensible person believes in the efficacy of a madstone.—T. D. is informed that we do not answer legal queries.—R. K. P. will find on p. 37, vol. 31, directions for making permanent magnets.—C. C. T.'s query as to cement for making rubber bags was answered on p. 139, vol. 35.—H. T., J. K., B. L., J. H., W. R., J. B. D., J. L., C. S. F., S. P. F. F., N. J. T., and others, who ask us to recommend books on industrial and scientific subjects, should address the booksellers who advertise in our columns, all of whom are trustworthy firms, for catalogues.

(1) W. A. C. says: I claim that the proper way to get the equation of panel wainscoting, ascending flights of stairs, should be to plumb up from the steps or stringboard. A friend claims that the proper way is to square out at right angles from the stringboard. Who is right? A. Your friend is right, if the object is to make the wainscoting upon the stairs appear of the same width as that upon the level floors of the building. It also requires the same amount of material to construct it per line or foot, measured upon the raking line of the cap moulding, as that upon the level floor following the line of the same moulding.

(2) F. S. asks: If, in a church design, it be desired to use a statue standing erect thirty feet above the observer, what height should be given the figure, according to scale? What is the rule for finding such height? A. Statues when set above the horizontal plane of vision should be sufficiently elongated to compensate for the dwarfing effect of the perspective. This does not refer to the size, but merely to the proportion between the width and the height. If you take a point distant 3 times the height as a proper station from which to obtain a good view of the statue, a line drawn from that point to the base of the statue and another from the same point to the apex, will limit the length of a line drawn across these starting at the base of the statue and running at right angles to the lower line from the eye; this cross line will indicate the height of the statue as it appears to the eye, and should be 6 feet. The statue itself should be of the increased height indicated by the vertical line at the end of the lines proceeding from the eye. But the width of the parts should be very slightly increased, if any.

Why does water discharge more rapidly through a tube than through an orifice of same size? A. It may be from the greater accumulation of the momentum which this form affords over the mere orifice. However, the fact is known, but not the cause.

(3) W. R. H. asks: What is the best method of treating shingle roofs so that the ice will not adhere so tightly near the eaves as to cause the water to back up and leak through? A. The remedy is to line your gutter with tin, and extend the tin up the roof to a width equal to that of 3 or 4 courses of shingles.

(4) M. A. says: I have an underground cistern in good order, which was well cleaned out before letting in water. The water now has a strong sulphurous taste and smell, which I am of opinion is caused by electricity discharged into it by means of the conductor pipes during a severe thunderstorm, as it had not this taste and smell previous to the storm. I am anxious to purify this water for drinking; can you suggest a method? A. The unpleasant taste, etc., of the water cannot be due to the effects of lightning. It may be due to the corrosive action of the water on the lightning rod terminals; but it is far more probable that the trouble is caused by decomposing vegetable matter. Throw into the cistern several bushels of well and freshly burnt charcoal. If this does not improve the water, try a little lime water, first experimenting on a small sample of the water to determine the proper quantity.

(5) D. S. M. asks: What is the shortest and most correct method of computing the cost of a certain amount of lumber at a given price per thousand feet? A. It is considered a very simple operation, and consists simply in multiplying the number of feet by the price per foot.

(6) H. D. D. says: I propose building a boat about the proportions of the Whitehall boat described in your SUPPLEMENT No. 37, but about twice the size, that is, 32 feet long by 8 feet beam. I will put in it a locomotive boiler 6 feet long by 2 feet, with which I will run two oscillating engines about 5 x 7 inches, with a screw 14 inches in diameter and of 3 feet pitch. The screw will work half below the keel, and be so arranged that in shallow water it can be elevated so as not to strike the bottom. This I will do by having a joint on the shaft; and the block by which the shaft passes through the stern post will slide up and down, having a guard running under the screw to a hinge on the keel, which on striking the bottom will force the block up the stern post. Do you think my plan is a good one? A. The screw is rather small, and we think your engines are larger than is necessary. 2. About what will be the draught? A. The draught can be made from 22 to 24 inches.

(7) N. M. H. asks: Can you tell me of a cheap paint or substitute for paint for brick walls? We

have been using some old bricks which show stains of mortar. What is a good substitute for oil and Venetian red? A. We do not know of any substitute that will be worth while to try.

(8) F. S. C. says: We are told that sulphate of lime is one of the most insoluble substances we have; in fact, that it cannot be dissolved in water; therefore, if we drink water containing it, it cannot be deposited in the system, causing gravel or other kindred diseases. What I cannot understand is this: Sharon Spring water contains 85 grains of sulphate of lime to the gallon; and when it is drawn from the spring (and that is the time we drink it) it is as clear as crystal, although after it has stood a few hours it becomes milky and opaque. If a little is split on the boots, it leaves a mark like a chalk mark. When the water is clear as a crystal, how can the sulphate of lime be otherwise than dissolved? And if dissolved, why does it not become deposited in the system? A. Sulphate of lime dissolves in water; but its solubility is not great. All spring waters contain more or less of it. The opalescent appearance in the water after standing is due to the separation of the other lime salts and carbonate of magnesia on the escape of the excess of carbonic acid, and the oxidation of the hydrosulphate of lime to form sulphate. As to why the lime in solution does not cause gravel and Bright's disease, it would be impossible to give other answer than that, in a healthy condition of the system, means are naturally provided for utilizing part of it as bone food, and for discharging that which is not required.

(9) F. S., Jr., asks: How can I make an artificial stone sidewalk? A. The most important ingredient is a good cement. English Portland cement is generally preferred. Procure a sharp, light-colored sand, and wash it free from all particles of soft earth or soil; also some stone chips, gravel, and large stone. Excavate the sidewalk about 18 inches deep, and fill in the large stone to within 6 inches of the surface; prepare a concrete made of the cement 1 part, stone chips and gravel about 6 parts, and bed it in upon the stone bottom to within 2 inches of the surface; then prepare a concrete of the cement 1 part and fine sand 2 parts, and lay it in up to the surface, floating the surface with the cement at pleasure. Finish by lining off into very regular blocks. A more economical sidewalk can be made by omitting the stone bed, but it will require a good hard soil to lay it on, and then will not be so sure of being permanent.

(10) J. H. D. says: About a year ago I bought some bleached shellac gum, and cut it with alcohol without any difficulty. A few days since, I tried some of the same gum, it having been kept in a dark dry closet; and it would only soften in alcohol, but not dissolve. After trying it in three different purchases of alcohol, I bought some more gum, and it worked all right. I would like to know why I could not dissolve the gum I had on hand? A. Break it into as fine a powder as possible, boil with clean water, and partially dry. We think it will then dissolve readily in alcohol, if the same be not too dilute.

(11) J. B. asks: Can a piece of iron drawn out square be termed wire? A. It would not be wire in the ordinary acceptance of the term.

(12) L. R. says: I asked you some time ago how to clean dirty lubricating oil. You said: "Filter it through plugs of cotton wool." I have taken a large funnel and put raw cotton in it, but it will not work. A. Agitate it with a small percentage of oil of vitriol, and then thoroughly wash it with water by agitation; syphon off the oil, and let stand over quicklime. To filter oil from mechanically contained impurities, fit a small cork, cut star-shaped, in the angle of a funnel, so that it will not impede the passage of liquids, and cover this loosely with cotton wool (raw cotton). If properly arranged, the oil will pass through, leaving the impurities in the cotton. 2. Please let me know how to wash dirty cotton waste? A. A strong, hot solution of soap and washing soda is generally employed. 3. Is there anything better for taking grease off waste than concentrated lye? A. Yes, bisulphide of carbon is much better.

(13) H. S. P. asks: Which runs lighter, a farm wagon with the usual sized thimble-axle axle, or a wagon of same size, etc., with an iron axle the thimble made tapering as usual? Does not the rule hold good in this case that the smaller the spindle, the less the friction? A. Yes, if the pressure does not become so great as to prevent efficient lubrication.

(14) J. McC. says, in reply to A. D. S., who asks how he can clean out his canal without drawing off the water: A very inexpensive dredging machine consists of a small scow, three men, a shovel with a long handle, and a rope. The shovel is made to take up, say a half bushel, and to have a bail to which to attach the rope. This shovel is manipulated by one man at the handle, who thrusts it into the mud, assisted if necessary by the other men pulling on the rope; and when the shovel is full, or supposed to be full, it is lifted up to the scow and emptied by being turned over by the man at the handle. If the canal is not very wide, a small mast and boom can be set up, and the shovel elevated to the end of the boom by running the rope through a single pulley block, when the shovel and its contents can be swung across the scow to the opposite bank, and the dirt deposited there.

(15) C. A. C. says: Please tell me how to stop foaming in a boiler? We have a 1½ horse power upright tubular, in use 15 minutes a day only, for steaming silk. I have tried black oil in vain, and am careful to draw with only ¼ open valve through ¼ inch pipe. It operated nicely till we accidentally got a little soap in it. I have blown off 5 times, but it is no whit better. A. Try the plan of running the boiler for a few hours with the blow valve partially open, and a strong feed; if the flow and check valves are so far apart that what is fed in will not be blown out again directly. If otherwise, run the boiler several hours, pumping up with a strong feed, and blowing down as often as practicable.

(16) W. B. says: I have seen it stated that experiments had been made in England not long ago, testing the draught of farm wagons of different con-

struction, and as a result it was found that a wagon with the fore and hind wheels of equal height was the easiest to move on any road or any grade. I wish to have the details of the above experiments or of the construction of the wagon. A. The experiments referred to were probably made by the Royal Agricultural Society of England. If so, you will find full details in their reports.

(17) F. G. W. asks: 1. What is the strength of a boiler 22 inches long, 10 inches wide, and 6 inches high, the heads of which are ¾ inch thick, of cast iron, and sides of wrought iron ¼ inch thick? The boiler has round ends with straight sides. A. Carry 25 or 40 lbs. steam. 2. Would it be suitable for an engine having a cylinder of 3 inches stroke by 1½ inches diameter? A. You can probably make the boiler answer for this engine. 3. If I put twelve 1 inch pipes in it, and set it on a common stove, would the boiler be improved? A. It will be more efficient if you use the flues as suggested.

(18) E. P. C. says: My steamboat is using a surface condenser; the boiler is only 8 months old with no grease or sediment in it; but I cannot keep the socket bolts from leaking, and every little while I have to renew them. What is the cause of it? A. In such cases, if the boiler is allowed to receive a very thin coating of scale, the corrosive action is often stopped.

(19) W. R. McD. asks: What can be done to prevent rust in a wrought iron warm-air furnace, enclosed in brick walls, when not in use? Is there not some way to prevent rust without making an application to the iron itself? A. We think you will find this difficult, unless you can expel the air, and seal the furnace hermetically.

(20) G. M. M. says: I have a cellar into which the water comes after a heavy continued rain. It is walled with stone and the walls are cemented. The floor or bottom has 2½ inches of hydraulic lime and gravel. How can I keep the water out? A. To make your cellar perfectly tight may be attended with considerable expense. It would require several coats of asphaltic cement applied on bottom and sides when the cellar is dry, and then loaded with brick or concrete of a weight equal to that of the water when at its highest point. When properly applied this would insure your cellar from water not only, but even from dampness.

(21) A. says: Miramichi (New Brunswick) raftsmen assert that rafted logs make headway through the water in floating down stream—that is, that they always go faster than the current; also that single logs go somewhat faster than the current, but are invariably passed by rafts; they also declare that a log with its ends up and down stream goes down faster than a log which drifts down sidewise. A. We would like to be sure that these assertions are founded on fact before attempting an explanation.

(22) W. W. E. says, in reply to A. D. S., who asked as to cleaning out his mill race: Put in sluice gates about every 200 or 300 yards, the bottom of which should be 12 or 18 inches below the bottom of the canal; then open one gate at a time, so as to drain the water from the canal, and the water will carry the mud and sediment with it. To facilitate the moving of the mud, put a small punt or flat-bottomed boat in the canal, get in it, and rock it until the water is moving rapidly under it. This has been my practice for 30 years. One hand can thus move more mud in one day than 30 hands can with shovels.

(23) O. H. Y. says: I would say to E. C. H., who asks how to put Babbitt boxes on a shaft without their becoming fast. Oil the shaft slightly and sprinkle the surface lightly with powdered plumbago. The shaft will slip out very easily and all the little holes in the box will be filled with a valuable lubricant.

(24) J. L. M. asks: Is there any process by which tin can be brazed? I wish to make a large number of smooth metal tubes capable of resisting mild acids. A. You fail to state what kind of acids. As a general thing, any ordinary metal or alloy cannot be trusted with even dilute acids. If the acid is dilute sulphuric, copper, lead, or an alloy of these may be used; but neither of these entirely resist the action of even very dilute muriatic, nitric, acetic acids. Tin offers more effectual resistance to some of them as it is seldom pure, it will also give away after a time. Perhaps the best, and certainly the most economical, way would be to enamel the exposed parts of the metal (see p. 21, vol. 36); or if this is impracticable, coat them with a varnish made of gutta percha, caoutchouc, or a mixture of the two dissolved in coal naphtha.

(25) W. E. says: I have a wooden tank to keep silver solution in. I tried pure pitch for lining, but the solution ate holes in it. What is the composition that is used for lining wooden tanks to hold silver solution? A. Wooden tanks are not best for silver baths. Use a paint made by dissolving equal parts of gutta percha and gum rubber in hot coal naphtha. Heat the naphtha over a large water bath.

(26) I. Q. G. asks: How can I paint a sign and apply small blue? What is used to make the small adhere, and how is it applied? Is the small dusted on and left till the background is dry? A. Dust in on a background of oil size.

(27) C. E. G. asks: What can I put into paraffin oil to prevent it from staining cloth, not destroying its lubricating qualities? A. We know of nothing.

(28) G. B. asks: How can I make gunpowder and gun cotton? A. For gunpowder the materials (charcoal, sulphur, and saltpeter) are first perfectly dried and separately reduced to impalpable powders. These are then sifted together, moistened with water, and ground for some time between large millstones kept constantly moist with water. The wet powder is then collected into large lumps and carefully dried. These lumps are grained by bringing them in contact with sharp teeth fixed upon the periphery of a revolving wheel, and agitating in suitable sieves to separate from the finer powder. The powder consists of 76 parts of niter, 13 parts of charcoal, and 11 parts of sulphur. Gun cotton is made by immersing clean dry cotton for a few moments in a mixture of equal parts of fuming sul-

phuric and nitric acids, and then washing the acids off in running water. The acids must be those known as fuming—the most concentrated.

(29) J. D. R. says: In the study of geology, I meet with one serious difficulty: There are five principal geological periods, each of which has its characteristic formations. Geologists speak of the "oldest rocks," the "lowest rocks," etc. All their examinations are necessarily confined to the earth's surface. How, then, do they ascertain which are the lowest or oldest rocks? I understand that eruptions might heave the rocks of the interior to the surface, and that rocks of all periods might be found on the surface; but how do geologists ascertain the period to which a given rock belongs? How do they tell the age of a rock? A. The older rocks—granite and basalt—are those upon which rest the stratified deposits constituting gneiss, sandstone, etc.; they are, therefore, often spoken of as the lowest, the foundation stones. They are unquestionably the result of direct conglomeration from a state of fusion; while the sandstones, etc., are as evidently the product of the corrosion and attrition by violently agitated water of high temperatures. The material thus abraded and dissolved, at first held in suspension by the water, was gradually deposited and cemented as it calmed and cooled. The rocky crust, at first formed, had become wrinkled into great valleys and mountain chains by the shrinkage of the still molten nucleus and the falling in of the weaker portions of the crust. The valleys received most of the sediment, while the mountain tops, some of which projected above the surface of the water, were lightly or not at all thus clothed. Denuding floods and glaciers have since laid bare portions of these foundation rocks or cut great chasms in them, so that geologists may, without great difficulty, study their nature and that of the superincumbent strata. The order of their formation, their inclination, thickness, stratification, and nature, are the data from which their relative ages are computed. Space will not here permit us to go further into the subject. You should consult some comprehensive works on geology and on the age of the earth.

(30) E. J. W. says: I have a wood-turning lathe, the cone pulley of which has two steps, one is $3\frac{1}{2}$ inches, and the other $9\frac{1}{4}$ inches in diameter. From center of spindle to center of countershaft is $31\frac{1}{2}$ inches. With the $3\frac{1}{2}$ inch step I am running a pulley on the countershaft $29\frac{1}{2}$ inches diameter. I wish to put a pulley on the countershaft to run with the $9\frac{1}{4}$ inch step, and to use the same belt on either step. What must be the size of the pulley? A. Make it $9\frac{1}{4}$ inches.

What is the weight and value of a cubic inch of gold? A. About $8\frac{1}{2}$ troy ozs. Worth about \$173.

How much heavier is a cubic foot of sea water than a cubic foot of fresh water? A. About $1\frac{1}{4}$ lbs.

(31) C. A. R. says: I desire a compound in liquid form, without offensive odor, which, when applied to ordinary writing paper or wood, will penetrate the same and adhere firmly thereto, and that will dry quickly when spread thinly, and exposed to the air. When dry, it should be transparent and insoluble in water. A. Perhaps an ethereal solution of balsam will answer your requirements.

Can you tell me what to add to silicate of soda to make it dry quickly when spread thinly? A. No. Use the solution hot.

(32) A. J. Z. & S. ask: 1. Is coal tar from gas houses a good thing to put on a shingle roof to preserve the wood? A. The use of coal tar as a roofing paint is open to a number of objections, chief among which are its black color and low point of fusion, which cause it, under exposure to strong sunlight, to readily absorb heat and run into the gutters, and its strong odor. Besides this it is very inflammable, and easily ignited. 2. Is there a cheap ingredient that can be mixed with it to make it dry, and to prevent it from smelling? A. The odor and liability to run may be somewhat reduced by mixing it with lime. It will not rot the wood.

(33) H. F. asks: How can I feather or crystallize on galvanized iron? A. Clean it perfectly with a solution of chloride of zinc, and you will find that the coating is already crystalline. Or use a wash of dilute nitric acid (1 of acid to 1 water), and wash in a stream of clean water.

(34) J. M. B. asks: What is the best material for a step in which a steel spindle, weighing about 1 lb., is to revolve at 4,000 turns per minute? A. Use hardened steel or iron.

(35) F. C. asks: How is the dotted shade put upon crayon drawings? A. If we understand you, the shade is composed of small dots worked in with the crayon point. 2. How can I obtain a solar print from a tin type? A. A negative of the picture is taken and is placed in front of the lens of a large camera and behind, but within the focus of, a large condensing lens. The sensitized paper extended on a frame is then introduced into the camera and exposed. The camera used for this purpose are peculiar in shape, very long, and are provided with suitable machinery, clockwork, etc., to maintain them in the same relative position with respect to the sun, during the time of exposure.

(36) W. C. R. says: A calcium light company has several different sizes of gas cylinders in use, holding 15, 25, 50, and 60 feet of gas; and when each one is fully charged and sent out, its pressure gauge will indicate the same number of lbs., namely, 225 lbs. to the inch. By what rule can I ascertain how many feet have been used, and how many still remain in the cylinder? A. The pressure varies nearly as the quantity of gas in the reservoir; so that, when the gauge shows a pressure only half as great as the original, about half of the gas has been used, and so on. A simple method of ascertaining the contents would be to weigh the reservoir when empty, and with a definite amount of gas. From this the weight of a cubic foot of gas could be ascertained, and, by weighing the reservoir at any time, a simple calculation would show how much gas it contained.

(37) L. N. M. asks: 1. What will prevent ordinary shellac varnish from bubbling under the brush, when applied to a rough surface? A. Thin with alcohol, and give a flowing coat. The wood must be dry. 2. In repainting defaced water colors, which would be

best, colored varnish or common paint, or would neither of them answer the purpose? A. You do not say what kind of a color. Probably colored varnish would give the best results, if we understand you.

(38) S. asks: Does the diameter of an eccentric affect the position of a valve, that is, will not a locomotive work as well with one eccentric of 10 inches diameter and the other of 12 inches, as it would were both equal, providing that the throw is the same? A. There is a slight difference on account of the increased angularity of the eccentric rod. All other things being equal, the small eccentric is best.

(39) E. D. S. asks: How can I split $\frac{1}{8}$ inch square iron either hot or cold? A. If the bar is heated to a red heat, a circular saw will answer. If the bar is cold, a fast running disk of sheet iron will cut it.

(40) G. W. R. asks: Can a steam cylinder of 3 inches bore work a 30 inch stroke? A. It would work, but would be very much out of proportion.

(41) J. W. C. asks: Can iron be welded without being heated to a welding degree, by the use of any chemical? A. No.

(42) W. F. S. says: A friend of mine says the Dead Sea is devoid of fish. I do not see why there should not be fish there as well as there is in any other water. Who is right? A. It is said to be lifeless, as its waters contain a very large quantity of chloride of magnesium, chloride of sodium, and sulphate of soda. A bath in its waters parches and cracks the skin.

(43) J. J. T. asks: How is it that all bought taps are so clean and bright? How are they tempered? A. The taps you refer to are not heated in the open fire but in heated mixtures, the composition of which we shall shortly publish.

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

J. S. B., of Cal., sends us a box marked with his initials, but no letter. It contains pieces of red jasper and quartz, with oxide of iron. The bright specks are not gold, but iron pyrites.—B. J.—No. 1 is clay with red oxide of iron. In No. 2 the bright specks are mica films, it contains no metals.—J. B., Jr.—It is red oxide of iron with clay. It is used as paint, under the names of ochre and umber.—G. B.—The crystals in No. 1 are lime iron garnets. No. 2 contains hornblende, albite, and orthoclase.—J. D. S.—No. 1 is iron pyrites in limestone. See p. 7, vol. 36. No. 2 contains carbonate of copper (malachite), limestone, and orthoclase. No. 3 contains galena (sulphide of lead). No. 4 is limonite, with a few crystals of pyrites.—A. D. T.—The material is an infusorial or diatomaceous earth. It contains very fine specimens of *plurasiema lanceolatum*, and *p. angulatum*.—A. J. A.—No. 1 is pyrites (sulphide of iron). See p. 7, vol. 36. No. 2. See "Hints to Correspondents," this page.—G. & B.—It is metallic antimony.—G. W. H.—It is bituminous shale. You will probably find coal by going deeper. Some of the shale might be used as fuel, but it contains much ash. Dr. M. B.—It is sand from decomposed granite, and is of no value.—H. M. H.—It is a kaolin (silicate of alumina) containing much tale or hydrous silicate of magnesia. It is not suitable material for crucibles, but might answer for soft firebricks.

J. H. B. asks: Is there any remedy for a parrot which, for four or five years, does nothing but pull his feathers out as fast as they appear?—C. B. T. asks: Can any one give me a recipe for manufacturing palatable cider from wild crab apples?—A. I. asks: Has there been anything invented to throw a paddle wheel off of its center? Many such wheels, and stationary engines also, stop in the dead center, and have to be pried off before they can start again.—G. S. says: I have seen in machine shops straight bars of iron 2 feet long, bolted on to shafting at different points and standing out at right angles. What are they for?

HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Inquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of inquiries analogous to the following are sent: "What do iron and steel rails cost? Are electric medical belts good for anything? What will a compression pump cost? Who sells incubators and brooding apparatus, and what do they cost? Where can powder paper be obtained? What does selenium cost per lb.?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

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INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States Were

Granted in the Week Ending

May 8, 1877,

AND EACH BEARING THAT DATE.

[Those marked (r) are renewed patents.]

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Agricultural boiler, T. S. Dobbs..... 190,424
Air engine, piston, etc., G. B. Brayton..... 190,411

Anti-incrustation compound, E. L. Hurd.....	190,436	Milk cooler, J. Maloney.....	190,604
Bag holder, A. Johnson.....	190,494	Mill spindle bush, H. T. Ashworth.....	190,463
Bale tie, H. C. Stouffer.....	190,641	Millstone driver, Burt & Whitney.....	190,414
Bale tie crimping tool, H. C. Stouffer.....	190,642	Millstone driver, W. Johnson.....	190,489
Band or cord, driving, S. Townsend.....	190,455	Mineral waters, C. Bayschlag.....	190,464
Bed bottom, spring, Smith & Beverstock.....	190,633	Motion, converting, Long & Lyon.....	190,601
Bedstead, sofa, H. Compes.....	190,556	Musical mouth piece, C. G. Conn.....	190,558
Bee hiving apparatus, R. B. Oldt.....	190,509	Nut lock, W. C. Harner.....	190,583
Beer measure, J. McInnes.....	190,607	Nut lock and washer, Mercer & Pownall.....	190,443
Bessemer steel ingot, J. Reese.....	190,448	Oils, etc., separation of, H. Frasch.....	190,483
Blacksmiths' tongs, J. H. Gregory.....	190,487	Ore washer, D. D. Hendrick.....	190,585
Booms, etc., sheave for, J. Edson.....	190,425	Ovens, illuminating, H. A. Stadler.....	190,637
Boot and shoe, H. Brosell.....	190,412	Paper bag machines, J. P. Raymond.....	190,619
Boot and shoe, H. White.....	190,655	Paper box, C. F. Taylor.....	190,454
Boot edges, burnishing, G. A. Fullerton.....	190,485	Paper feeding machine, E. H. Johnson.....	190,596
Boot sole fastening, L. Goddu.....	190,575	Paper pulp, process for moulding, S. Wheeler.....	190,654
Boot soles, trimming, Foster & Tolles.....	190,482	Pencils, etc., printing lead, H. B. Horton.....	190,589
Boot cleaner, D. H. Laurie.....	190,598	Pianoforte attachment, A. Steinway.....	190,639
Boot jack, J. Niver.....	190,508	Piano frame, W. Muth.....	190,507
Boot edge ball, C. L. Jones.....	190,495	Picture frame, S. Sargeant.....	190,517
Boots, treating leather for, J. J. Sawin (r).....	7,667	Pipe coupling, J. Old (r).....	7,673
Box and box holder, J. A. Cotton.....	190,471	Pipe-moulding machine, H. R. Smith.....	190,634
Boxes, making wooden, W. Huey.....	190,590	Pipe tongs, States & Cook.....	190,523
Brake lever, E. H. Wheeler.....	190,458	Pipes, coupling for lead, G. H. Webster.....	190,651
Brass, cleaning and polishing, W. H. Bertram.....	190,407	Plow, Beard & Purcell.....	190,538
Brick machine, T. McNicholas.....	190,505	Plow, J. R. Jackson.....	190,593
Bridge, W. Irelan.....	190,457	Plow, Lauer & Hartmann.....	190,500
Bridge truss, R. H. Davies.....	190,562	Plow, gang, G. H. Wilson.....	190,460
Bridle bit, A. C. Tickner.....	190,646	Plow, sulky, W. S. Weir.....	190,652
Burial casket, H. Sander.....	190,625	Plows, etc., colter for, J. Oliver.....	190,510
Can opener, L. Cutting.....	190,509	Preserving animal substances, G. Henry (r).....	7,672
Capstan, C. Rogers.....	190,623	Preserving fruit, Burst & D'Autrey.....	190,415
Car axle box, E. L. Colman.....	190,468	Protractor, R. T. Osgood.....	190,611
Car coupling, C. M. Carnahan.....	190,418	Pulley block, G. A. Ford (r).....	7,671
Car coupling, A. S. Albright.....	190,532	Pump, air, Moll & Altheide.....	190,610
Car spring, W. P. Hansell.....	190,582	Pump, portable, W. H. Paulding.....	190,512
Car, tank and freight, H. G. Brooks.....	190,542	Pump valve, G. H. Corliss.....	190,469
Cars, propelling, G. T. Beauregard (r).....	7,665	Railway track clearer, A. Day.....	190,593
Carbureters, float for, J. Clingman.....	190,419	Refrigerator car, R. Burrows.....	190,416
Card board for perforating, Dreyfuss & Sachs.....	190,477	Revolving fire arm, Brooks & Bearcock.....	190,543
Carriage king bolt, J. H. Combs.....	190,555	Rolling articles of metal, A. Reese.....	190,620
Carriage top, G. F. Canniff, Sr.....	190,549	Sash fastener, J. H. Schlott.....	190,451
Carriage shifting rail, A. M. Whipple (r).....	7,665	Sashes, etc., clamping, J. Collins.....	190,554
Churn, S. Blair.....	190,406	Saw gummer, Leftwich & Crossley.....	190,599
Churn, W. C. Burton.....	190,466	Saw handle, crosscut, P. Gerlach.....	190,574
Churn, reciprocating, R. E. Grimes.....	190,578	Saw set, Smerdon & Phillips.....	190,521
Churn, rotary, H. L. Gordon.....	190,576	Saw set, C. H. Turver.....	190,647
Churn, rotary, C. I. Hale.....	190,581	Saw handles, attaching, C. F. Spooner.....	190,522
Cigar lighter, automatic, M. L. Ross.....	190,450	Saws, etc., setting teeth of, L. H. Bigelow.....	190,539
Cigarette machine, H. H. Bromwell.....	190,541	Sawing machine, C. Bliven.....	190,540
Cigarette machine, C. Palatini.....	190,613	Scale measure, J. Putnam.....	190,447
Clasp for wristbands, A. V. Sanford.....	190,626	Screw driver handle, H. Wilkinson.....	190,459
Clevis, W. S. Weir.....	190,633	Selditz powders, putting up, C. R. Doane.....	190,564
Clock alarm, R. Sayer.....	190,518	Seed-planting machinery, W. Gilman.....	190,486
Cloth spreader, etc., C. A. Luther.....	190,600	Sewing machine, W. A. Dawson.....	190,475
Clothes drier, G. B. Stephenson.....	190,524	Sewing machine housing, T. A. Wilson.....	190,658
Coal box, G. M. Church.....	190,533	Shirt-drying apparatus, J. McCartan.....	190,605
Coal hod, W. S. Potwin.....	190,514	Shoe, A. H. Herring.....	190,433
Coffee huller, J. H. Pendleton.....	190,614	Show case, P. Henriks.....	190,586
Coffee, hulling and polishing, H. B. Stevens.....	190,453	Show case, S. Stein.....	190,608
Collar and toy money box, Mack & Cook.....	190,504	Shutter bower, etc., W. H. Fitz Gerald.....	190,479
Compound engine, Archbold & Haug.....	190,534	Skid, W. S. Babcock.....	190,404
Corn gatherer, M. P. Brown.....	190,546	Slate cleaner, E. M. Swift.....	190,444
Cotton press, A. Baldwin.....	190,405	Spectacle joints, etc., making, D. C. Winans.....	190,659
Cradle, rocking, I. Bushong.....	190,417	Spectacles, C. Yocco.....	190,530
Cultivator, T. W. McDill.....	190,606	Spinning machine, G. E. Taft.....	190,525
Cups, securing handles to, C. S. S. Baron.....	190,537	Spinning top, A. J. Davis.....	190,421
Curling iron, C. Magg.....	190,602	Spool stand, W. S. Hotchkiss.....	190,491
Curtain fixture, H. Broom.....	190,544	Springs, making elliptic, A. French (r).....	7,669
Curtain fixture, Williams & Kerr.....	190,656	Square, C. A. Schrier.....	190,519
Decanters, etc., lock for, E. H. Guild.....	190,579	Stalk cutter and hay rake, W. W. Fuller.....	190,484
Dental engine, C. M. Curtis (r).....	7,670	Stave sawing machine, G. C. Stevens.....	190,482
Door bolt, F. Davis.....	190,561	Steam boiler, sectional, T. Weston.....	190,457
Drawer pull, G. W. Tucker.....	190,527	Steam engine, W. J. F. Liddell.....	190,441
Drier, W. Pickhardt.....	190,616	Steam generator, C. S. Smith.....	190,622
Drying cylinder, C. C. Butterworth.....	190,543	Steamer for cooking feed, A. K. Brown.....	190,545
Dust pan, I. S. Lauback.....	190,499	Stove, J. Spear.....	190,655
Egg beater, J. H. Scofield.....	190,628	Stove, coal oil, J. A. Frey (r).....	7,674
Egg crate, W. J. H. Kappe.....	190,440	Stove, cooking, Van Buren & Liddle.....	190,645
Eggs, desiccating, W. O. Stoddard.....	190,640	Strap fastener, W. Hyre.....	190,495
Envelope, W. S. Holding.....	190,588	Suspenders, L. V. Richmond.....	190,515
Envelope, J. A. S. Simonson.....	190,630	Switch, signaling, W. Buchanan.....	190,465
Exercising machine, A. W. Lozier.....	190,503	Tag machine, H. D. Mentel.....	190,506
Fare register, A. E. Post.....	190,617	Tea caddy, Hemp & Knight.....	190,584
Feed water heater, J. Eckersley.....	190,567	Telegraph, printing, E. P. Warner.....	190,456
Fence, Sumpter & Brown.....	190,643	Textile fabrics, ornamenting, R. Le Roux.....	190,501
Fence, portable, S. G. Burke.....	190,547	Ticket case, Lloyd & Conkey.....	190,602
Fences, post for wire, S. Reynolds.....	190,621	Tin scrap, utilizing, Catlin & Wilson.....	190,530
Fire escape (hydraulic), Gerard & Turnbull.....	190,573	Tobacco caddy, L. M. Fitzhugh.....	190,568
Flax, etc., treating, N. De Landtsheer.....	190,476	Toy aeroplane, W. S. Hull.....	190,591
Flower stand, C. F. Hall.....	190,580	Toy cap exploder, W. G. Fischer.....	190,481
Food, composition, J. T. Cragin.....	190,472	Toy cigar case, F. Waldschmitt.....	190,528
Frost on windows, preventing, Anthony et al.....	190,533	Toy, spinning, J. H. Jenkins.....	190,438
Fruit conductor, I. W. Curtis.....	190,539	Trace fastener, C. S. Crittenden.....	190,473
Fruit jar, T. G. Otterson.....	190,612	Trumpet for railway heads, etc., P. C. Dawson.....	190,422
Galley support, P. A. Kelly.....	190,497	Turbine water wheel, W. B. Jenkins, Jr.....	190,538
Garbage sink, T. X. Walsh.....	190,649	Twist drills, making, C. F. Jacobson.....	190,592
Garter, F. Armstrong.....	190,535	Type, distributing, J. M. Howe.....	190,434
Gas burner, J. Halstrick, Jr.....	190,431	Umbrella, E. Charagant.....	190,551
Gas, etc., generating, M. W. Kidder.....	190,498	Umbrella handle, F. J. Kaldenberg.....	190,496
Gear cutting machine, G. H. Corliss.....	190,470	Upholstery fiber, preparing, J. S. Cutter (r).....	7,668
Grain binder, F. W. Randall.....	190,515	Valve, cut-off, F. A. Bishop.....	190,408
Grain conveyor, A. J. Emlaw.....	190,427	Vapor burner, H. W. Wilson.....	190,529
Grain drill, M. M. Fitzgerald.....	190,480	Wagon, J. W. Rittenberry.....	190,622
Grain gatherer, etc., R. Eickemeyer.....	190,426	Wagons, step for platform, C. Conderman.....	190,557
Gun machine, J. P. Taylor.....	190,645	Water call or signal, Osborn & Drayton.....	190,511
Gutters, machine for making wooden, J. Dole.....	190,565	Washing machine, R. Chartrey.....	190,505
Gutter clamp, D. A. Wilson.....	190,557	Watch chain bar and hook, W. S. Hicks.....	190,468
Hame fastener, A. A. Phillips.....	190,513	Water filter, Fleming & Burns.....	190,569
Hame fastening, S. A. Woodard.....	190,661	Water meter, A. B. Arnold.....	190,556
Hame for harness, G. E. Fletcher.....	190,570	Water pressure cut-off, F. McLoughlin.....	190,442
Hoe, A. Schwehr.....	190,520	Water tubes, cap for, R. P. Thompson.....	190,528
Horse collar pad, A. Foley.....	190,428	Weather strip, F. Davis.....	190,420
Horse detacher, Amidon & McKimm.....	190,461	Well, bored, R. A. Ryrie.....	190,524
Horse hay rake, W. Adriance.....	190,531	Whiffletree hook, H. H. Hull.....	190,480
Horse hay rake, W. S. Archer.....	190,462	Windlass, portable, D. Janssen.....	190,594
Horse hay rake, C. C. Bradley.....	190,410	Windmill, W. D. Griffith.....	190,439
Hot air engine, Hock & Martin.....	190,490	Windmill, D. Halladay.....	190,430
Hydrocarbon oil, supplying, W. Major.....	190,603	Window jack, D. M. Pfautz.....	190,615
Indicator, G. W. Daniels.....	190,474	Window screen, Hochkoffer et al. (r).....	7,664
Iron moulding, J. Hursh.....	190,492	Wire bands, cutting, C. H. Chadbourn.....	190,467
Ironing apparatus, P. O'Thayne.....	190,444	Wrench, L. S. Starrett.....	190,409
Labels, attaching, C. L. Pond.....	190,446	Yarn-drying machine, Meissner et al.....	190,609
Lactometer, L. Heusner.....	190,597	Yoke, neck, G. W. Hurd.....	190,435
Lamp chimney, H. R. Crosby (r).....	7,659	Yokes, shaping clip, M. Seward.....	190,437

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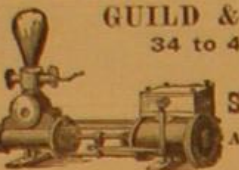
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[NEW SERIES.]

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IMPROVED FIRE-EXTINGUISHING APPARATUS FOR VESSELS.

It is not two months since a fine steamer with a cargo of merchandise left Savannah for Nassau. The vessel had but fairly got to sea, when a cask of spirits, which had been improperly stored, broke adrift and leaked; and in some way the fluid caught fire. Although the ship had approved fire pumps, water was found useless against the intensely hot flame which almost instantly communicated itself to the timbers. Of the crew and passengers, who took to the boats, but few were saved. The vessel was entirely consumed. Here was a case where water as a means of extinguishing fire proved wholly inadequate; and we can recall no better illustration of one class of instances where such an invention as that which we are about to describe would have proved perhaps the only efficient means of protection. Again, a year or two ago, an oil ship in a French harbor caught fire. Every effort to put out the flames was futile; and the conflagration, extending to other craft, bid fair to burn all the shipping in the vicinity. A United States man-of-war in the port sent out her boats and towed the burning vessel into the roads, where she finally sank. This is an example of still another class of cases where a fire afloat, unless promptly overcome, is almost certain to result in large loss of property. We have repeatedly in these columns dwelt on the inefficiency of modern appliances in preventing disasters of this description. In a heavily laden vessel at sea, it is even dangerous to pour in water in sufficient quantities to extinguish fire, for the reason that the ship herself may thereby be sunk; and in a harbor there is always the peril of the flames extending to the light inflammable rigging of other ships, even if the difficulty of obtaining a full supply of water under pressure, at any given locality, does not exist. Suggestions have not been wanting for the use of carbonic

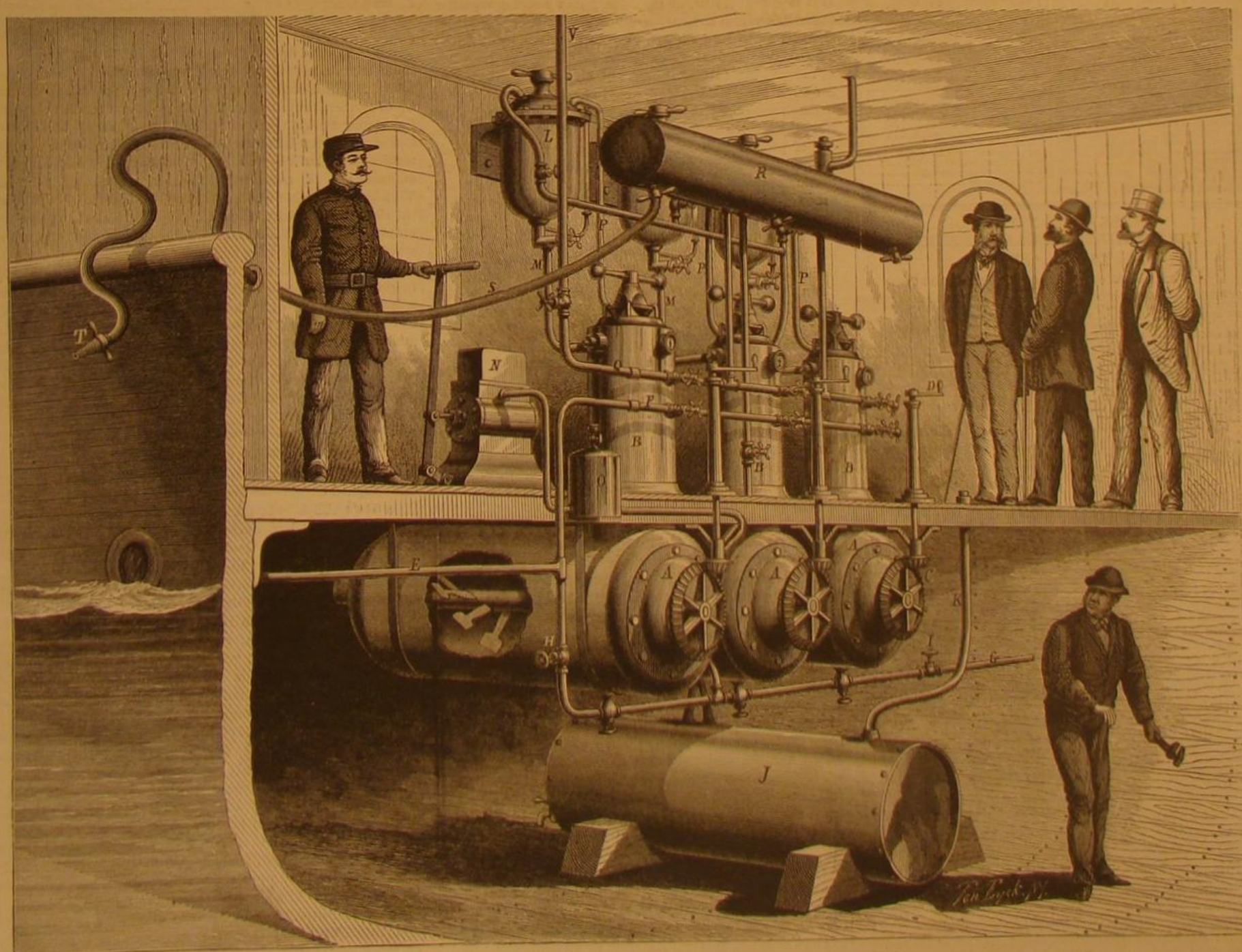
acid gas as a fire extinguisher on shipboard, based on the successful utilization of the same in chemical engines and other patent devices ashore; but the problem has been how to establish apparatus, in the narrow confines of a ship's hold, which will be perfectly safe, and always ready to afford an instant and full supply of the gas. This is claimed to be solved by the invention here presented; and if we may judge from the successful issue of the trials to which the same has been subjected, the claim must be considered as well as substantiated.

The general principle on which the apparatus is based is the direct use of the dry gaseous carbonic acid in smothering volume, in contradistinction to the ordinary employment of limited quantities of the gas dissolved in water under pressure. The means for carrying out the invention are represented in our large illustration, Fig. 1. The generators, A, are copper cylinders, capable of withstanding some 300 lbs. pressure, lined with tin to resist the acid, and suspended by straps under the deck beams. These vary in number, according to the requirements of the size of the ship, and preferably are about 26 inches in diameter by 9 feet in length, so that each holds about 448 lbs. bicarbonate of soda mixed with water to a paste. Domes, B, extend upward from the generators to a height of 36 inches, and through these the chemicals are admitted. In each generator (as shown by the broken-away portion of one) is a horizontal shaft on which agitating vanes are spirally disposed. When these shafts are rotated, by means of the bevel gearing, C, and cranks, D, a slowly moving current of acid is carried through the soda, and thorough mixing insured. Each dome has a hinged removable cover, Fig. 2. When these covers are closed, they are turned beneath lugs on the dome, and the cap proper is tightly adjusted by lever and screw. Opening outboard is a water supply pipe, E, which communicates with two branch pipes, F and G, respectively above and below the

generators. The pipe, F, serves to conduct water to the latter. The pipe, G, may be used as a waste pipe, as it leads outboard on the other side of the vessel; or when the valve, H, is opened, and the valve, I, closed, it conducts water from E, into the cylinders from below, to break up the caked residuum before discharging the same overboard. The acid reservoir, J, is firmly secured on the bottom of the vessel. It is thus situated apart from the other machinery, so that the corrosive action thereon of its contents is avoided; while, if it should leak, no harm would be done, as the acid would simply run into the bilge. The cylinder which has a capacity of 213 gallons is made of one quarter inch lead reinforced by an iron shell, which, while strongly backing and holding the weaker metal, may be easily removed when the inner case needs repairs. The reservoir is charged from the deck above through the pipe, K. The vessels, L, are intermediate and distributing receptacles, to hold the acid in small amounts until needed, and also to apportion the charges to the respective generators. They are of copper, lead-lined; they possess gauges for showing the level of their contents, and are directly connected with the domes, B, by pipes, M. To fill these vessels, a pipe is provided which extends into and near the bottom of the acid reservoir. From this, branch pipes lead to the separate chargers. An air pump, N, the lever of which is shown in the hands of the figure, forces air by a small pipe into the acid cylinder; and the pressure generated drives the acid up through the conduits and into the chargers, L, in quantities as desired. Valves are provided, so that one or all of the chargers may be filled. The alkali generators have like valves in the water pipes, so that water may be admitted to as many as needed.

The carbonic acid gas may itself be used for forcing up the acid by causing the pressure generated in a portion of

[Continued on page 388.]



GRANGER'S APPARATUS FOR EXTINGUISHING FIRE ON SHIPBOARD.—Fig. 1.

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VOL. XXXVI, No. 25. [NEW SERIES.] Thirty-second Year.

NEW YORK, SATURDAY, JUNE 23, 1877.

Contents.

(Illustrated articles are marked with an asterisk.)

Alum in bread, estimating.....	330
American Science Association.....	330
Answers to correspondents.....	330
Axles, greasing.....	331
Babbitt metal boxes (1).....	331
Beef extract, dissolving (2).....	331
Birds' nests.....	332
Bismuth, purification of.....	332
Blowpipe apparatus.....	332
Blue glass blindness.....	334
Bread, etc., adulteration of.....	331
Business and personal.....	331
Calf muzzles.....	332
Carbonic oxide, test for.....	332
Cement, very hard (11).....	332
Chimneys, building (2).....	332
Chlorides for watering streets (2).....	332
Cistern, leaky (7, 20).....	332
Cockroach utilized, the.....	331
Coins, non-ferrous (13).....	332
Cords, strength of (5).....	332
Correspondence, Washington.....	332
Disinfecting drains, etc. (9).....	332
Drunk or diseased.....	334
Electricity in galvanism, etc.....	331
Employers and working men.....	332
Engine, steam ports of an (4).....	332
Engines, cut-offs of (3).....	332
Files cracking in tempering (6).....	332
Fires in ships, extinguishing.....	332
Fishes, perspiration of (19).....	332
Flowers by mail (16).....	332
Fly paper (2).....	332
Fruit, American, in Europe.....	332
Gold, transparent.....	332
Governor, the Allen.....	332
Grain elevator, New York city.....	332
Gravestones, about.....	332
Guns for Turkey.....	332
Heat, nonconductors of (3).....	332
Heated air for the lime light.....	332
Heliograph, the.....	332
Horn, clarifying (4).....	332
Horse boot.....	332
Hothouse, building a (26).....	332
Ink, new copying.....	336
Inventions patented in England.....	336
Inventors, helping.....	336
Knowledge is power.....	336
Lathe for turning iron (2).....	336
Lightning rods.....	336
Machine shops, waste in.....	336
Magnets, connecting (27).....	336
Magnets, making (25).....	336
Marbleizing iron (37).....	336
Metals, preserving.....	336
Milk and butter.....	336
Mirrors, dull (15).....	336
Moulding in plaster (38).....	336
Mount Carmel, Ill.....	336
Nickel, melting (42).....	336
Ohm, the (34).....	336
Oleomargarin, detection of.....	336
Parchment, damp (37).....	336
Patent decisions, recent.....	336
Patents, American and foreign.....	336
Patents, official list of.....	336
Petroleum trade of New York.....	336
Photography, chemistry of (23).....	336
Pipes, water through (30).....	336
Plating and polishing machine.....	336
Plating, cleaning before (32).....	336
Polishing gun stocks (30).....	336
Potato bugs and potassium (41).....	336
Powder paper (13).....	336
Practical mechanism—No. 29.....	336
Riches and reason.....	336
Rifle, the Peabody.....	336
Silver plate, discolored (12).....	336
Slide valves, lap on (5).....	336
Stains, apple, on muslin (19).....	336
Stains of oil on granite (14).....	336
Steamboat trip, the first.....	336
Sweating in buildings (7).....	336
Tornado in Illinois.....	336
Tortoiseshell, scraps of (10).....	336
Walls, brick and stone (31).....	336
Waterproofing pants (33).....	336
Whalebone (9).....	336

TABLE OF CONTENTS OF
THE SCIENTIFIC AMERICAN SUPPLEMENT,
No. 77,
For the Week ending June 23, 1877.

- I. ENGINEERING AND MECHANICS.**—Boilers of the Havemeyer Sugar Works, New York. With 5 engravings.—On the Mechanical Firing of Steam Boilers. By W. J. PEARSE. An interesting and valuable paper lately read before the Society of Engineers, London. With one page of engravings.—Oliver's Distilling Apparatus for coal gas liquor. By Dr. G. TH. GIBB. 4 illustrations.—Pipes for Gas and other purposes. Main-Laying. Three engravings.—The Waterworks at Bangor, Maine, by L. H. EATON, C.E., Engineer Bangor Water Board. 1 illustration.—Thornycroft's Screw Propeller, with 2 illustrations.—Paddle Engine for Light Draught Steamers, 1 engraving.—The City of Pittsburgh, with an account of its Manufactures.—On the Minute Measurements of Modern Science. By ALFRED M. MAYER. Article VIII. The Cathetometer and its practical applications, 2 figures.—New Water Heater for Steam Engines. Improvement in Iron and Steel Manufacture. By T. A. FREEMAN.
- II. TECHNOLOGY.**—Fifty Practical Recipes. Elmer's Green, Bremen Blue, Wild Yellow Lake—Treating Lubricating Oils.—A new Solvent for Silk.—Portraits in Water Glasses.—Iron and steel Manufacture.—Machine for Drying Crystals. 1 engraving.—Pipes for Gas and other purposes. Main-Laying. 3 engravings.—Inventions and Improvements announced Abroad, including the following items: Loading Silk; Cleaning Yarns by Friction; shuttle Improvements; Dyeing Long Files; Jacquard Improvement; Novel Method of Ornamenting Velvet and Plushes; Extraction of Soap; Quill Brags for Combining Engines; Brilliant Cotton and Hemp; Sorting Bags; Bleaching Wool; Olive Wood for Shuttles; New Mode of Decorating Muslins.—Designs for Ornamental scissors, Knives, and Forks. 1 engraving.—Fifty Syrup Recipes for Household purposes, Mineral Waters, etc., to wit: Simple Syrup, (2) Lemon Syrup, Mulberry Syrup, Vanilla Syrup, Vanilla Cream Syrup, (2) Cream Syrup, Ginger Syrup, Orange Syrup, (2) Pineapple Syrup, Nectar Syrup, Sherbet Syrup, Grape Syrup, Banana Syrup, (2) Coffee Syrup, Wild Cherry Syrup, Wintergreen Syrup, (2) Sarsaparilla Syrup, Maple Syrup, (2) Chocolate Syrup, Coffee Cream Syrup, Ambrosia Syrup, Hock and Claret Syrup, Seltzer Syrup, Capesin Syrup, Cherry Syrup, Strawberry Syrup, (2) Raspberry Syrup, Peach Syrup, Blackberry Syrup, Orange Syrup, Catapaws Syrup, Milk Punch Syrup, Champane Syrup, Sherry Syrup, Elderberry Syrup, Fancy Syrup, Currant Syrup, Framboise Syrup, Maidenhair Syrup, Orange Flower Syrup, Cinnamon Syrup. How to make Syrups Frothy. Colours for the Sick Room, by GEO. LEIS. With recipes for the production of preparations that serve as pleasing perfumes, deodorizers, and cosmetic lotions.
- III. CHEMISTRY AND METALLURGY.**—New Oxygen Retort, by Wm. J. CHADWICK. 2 figures.—Preparation of Pure Hydrogen.—Explosion of Nitro-hydrochloric Acid.—Synthesis of Urea.—Estimation of Boracic Acid.—Formation of Saltpetre by Organic Ferments.—Density of Alum Solutions.—New Method of Manufacturing sulphides, Carbonates, and Kermes.—Action of Hydrochloric Acid of Soda on the Hematin of the Blood.—New Ureometer for Clinical Use.—Neptunium, a New Metal.—Selenium and Refined Silver.—Proceedings of the German Chemical Society, Berlin. With notices of a large number of new researches by prominent members.
- IV. ELECTRICITY, LIGHT, HEAT, SOUND, ETC.**—Electricity in the Production of Galvanic Deposits and of Chemical Decomposition.—New Investigations in the Compound Electroplating Bath, by M. THOMAS.—Lighting.—Improvement in Dynamo-electric Machines, by DISNEY & J. L. LOSTON. 3 engravings.—The Cause of Light in Flames.—Tonometry, or the Measurement of Sound, by A. J. ELLIS. An interesting and instructive paper.—Underground Telegraph Lines in Paris.
- V. ASTRONOMY.**—Structure and Origin of Meteorites; explaining the Interior Structure of Meteorites, the formation of Minerals and Rocks, Origin of Meteorites, Meteoric Iron, Testimony of the Microscope. An interesting paper. By H. C. SORBY, F.R.S.—The Asteroids, by Professor C. A. YOUNG.

BLUE GLASS BLINDNESS.

It is curious to notice in what strange ways a popular mania affects different people. The believers in the blue glass absurdity have hitherto had a monopoly of wild theories on that subject, of which they have invented no lack, to meet the various objections raised, but here is a blue glass skeptic gravely making assertions fully as baseless as the errors which they are aimed to controvert. The skeptic in question is none other than our staid contemporary the *Evening Post*, of this city; which, in its anxiety to warn its readers against an apparent danger inherent in blue glass, perpetrates the following:

"That blue glass has any curative properties remains yet to be proved; but that glass of that color will concentrate the rays of the sun, in a lesser degree, as the common burning glass does, was known before General Pleasonton's book was printed and made so much of by the newspapers. A gentleman of Brooklyn suffering from weakness of sight was recently led by the advice of well meaning friends to use spectacles of blue glass, such as certain opticians are selling just now. The result was that his eyes, already too weak to be used much in ordinary circumstances, were exposed to a terrible glare and heat, which in less than a week entirely destroyed the eyesight of the sufferer. He is now totally blind. This is a fact, and the gentleman would doubtless be glad to have other sufferers from weak eyes know of his case and draw a moral therefrom. Another similar instance has come under our observation, a young lady being in this case the dupe of the blue glass enthusiasts. It is worth bearing in mind that the only property of blue glass that has been proved is its power to concentrate the rays of the sun and produce extraordinary heat."

Neither glass stained blue nor glass of any other color "concentrates the rays of the sun as the common burning glass does." A lens, from the curvature of its surface or surfaces, has the property of causing the luminous rays which traverse it either to converge or to diverge. By a burning glass or double convex lens, parallel rays are conveyed to a focus. If blue glass is made in similar form, it will act similarly; otherwise it will not.

But, as we have repeatedly pointed out, blue glass cuts off a very large proportion of the luminous rays, and the light it transmits is nothing but modified sunlight, or rather sunlight shaded and reduced in intensity; so that, so far from blue glass producing a terrible "glare," it transmits an exceedingly mild light. This property was utilized by photographers long ago in order to relieve the eyes of their sitters; while blue spectacles have been worn by weak-eyed people almost ever since spectacles were contrived.

It is not necessary to discuss the question of whether blue glass becomes hotter through absorption than clear glass, in the absence of any authentic experiments on the subject. It is well settled that, as color teaches us nothing regarding the radiation and absorption of non-luminous heat, any conclusions as to its influence may well be wholly delusive. The absorption depends on the particular absorptive power of the coloring substance, and not on its hue. Clear glass is opaque to a considerable degree to heat rays, and therefore through absorbing them becomes warmed. The only question, then, is whether the coloring matter introduced is capable of producing increased absorption sufficient to render the glass hot, and so to cause it to injure the delicate outer portion of the eye through its proximity thereto. In the absence of any data determining this point, no positive opinion can be formed; but it seems probable that the resulting inflammation of the organ would produce suffering sufficiently intense to indicate its cause to the wearer of the glasses and induce him to discard them before the week had elapsed during which the lesion became permanently extended to the optic nerve. It should be understood, however, that, if blue glass spectacles are injurious, it is because of the constitution of the glass, and it does not necessarily follow in consequence of that glass being blue.

DRUNK OR DISEASED?

The sciences of law and medicine are now in direct conflict on the question of the responsibility of the inebriate. The law holds a drunken person answerable for his acts, and refuses to accept intoxication as a plea in extenuation. On the other hand, one of the highest medical authorities, who has made drunkenness the subject of prolonged and careful study, Dr. D. G. Dodge, late Superintendent of the New York State Inebriate Asylum in Binghamton, says that "inebriety is a condition of the system exhibiting a class of symptoms resulting from a long continued and excessive use of alcoholic stimulants, which brings the subject to a condition he is too weak to overcome; and for which he is not responsible." Society, it would seem, stands in a dilemma from which it is difficult to perceive any present way of escape.

The question is one, however, which demands speedy settlement, for laws are indeed anomalous under which fine-drawn pleas of "emotional insanity" have secured immunity for wilful murder, while the wretch who deals a fatal blow while crazed and diseased with drink is subjected to the full meed of punishment. Much has been written and said to prove that, when a man becomes a drunkard, it is a voluntary proceeding on his part. This is the legal view—or rather, the legal fiction—relative to the subject. There is no doubt that many do become confirmed inebriates through finding pleasure in their early use of stimulants; but this is by no means true of all. Dr. Dodge tells us that, like all hereditary diseases, intemperance is transmitted from parent to child as much as scrofula, gout, or consumption; that it observes all the laws of transmitted disease; that it may even

skip a generation, and appear in a succeeding one with all its former activity; that the habit seldom culminates until the subject is thirty years of age, and that the disease is oftenest found among people between the ages of thirty and forty; that certain individuals possess an alcoholic idiosyncrasy, a natural latent desire for stimulants which leads, if indulged, to morbid appetite and a diseased condition of the system, which the patient is powerless to relieve, because the weakness of will that led to the disease obstructs its removal. These are all well demonstrated facts. Dr. Joseph Parrish says that he has known hereditary drunkenness developed after sixty years of sobriety. Dr. Forbes Winslow, before a British Parliamentary Committee, stated that he had observed a list of criminals in which a father was a drunkard, grandfather a drunkard, grandmother an idiot; and in the whole line the family showed drunkards, criminals, and idiots. All the forms of vice were hereditarily transmitted.

The difficulty at once suggests itself of how to distinguish between the man who gets drunk because he cannot help it and then sins, and him who deliberately becomes intoxicated. If we place the drunkard on the same level as the lunatic in regard to irresponsibility for crime, we find ourselves brought face to face with a host of perplexing questions. A man cannot sham lunacy without being reasonably sure of detection; but he can get genuinely drunk, and still have faculties clear enough to execute a purpose of revenge, for example. Neither law nor medicine can positively say how drunk a man must be to be irresponsible. Neither can we unearth every one's genealogy to find out whether his grandfather was an inebriate in order to predicate the hereditary hypothesis. It is evident, therefore, that the drunkard—no matter how he became a victim—must be placed in a different category from the lunatic and the criminal who commits crime automatically. A lunatic is never responsible, society must regard a criminal as always so; but the responsibility of the inebriate depends on a host of circumstances, which may differ in countless instances. It is obviously as much an error to regard every drunkard as an automaton impelled by irresistible impulse as it is to consider him—as we now practically do—a fully reflecting being. The problem is to find the just mean which will cover all cases, or to discover a mode of prevention which will simplify the general conditions.

The preventive remedies which have suggested themselves are two: First, the inebriate asylum; second, the repression of the liquor traffic. The inebriate asylum, though really a curative institution, is in the end the means of preventing the spread of inebriation by hereditary transmission. Intemperance is curable, just as insanity is, in most cases; and, to a certain extent, similar means are used to effect the desired result. The treatment, however, involves skill and thorough acquaintance with the disease in all its forms; and it is therefore of a nature which is best practised in special institutions. The increase in number of the latter may therefore be considered advantageous. As regards the checking of the liquor traffic, there is ground for much argument *pro* and *con*. A step in advance which might be taken, and its results tested before resorting to prohibition, is the stringent enforcement of enactments against adulterated liquors. Whiskey—or rather a vile decoction of fusel oil—is sold in the slums of this city, at retail, at prices less than the government tariff alone amounts to. Repression of adulteration would break up the sale, and place liquor out of the pecuniary reach of thousands of people who are now easily able to gratify their desires. Pure liquors, say authorities, are worse as a source of inebriation than the adulterated ones, owing to the greater proportion of alcohol present. This is doubtless true; but at the present time the immense preponderance of liquor sold is adulterated. Enforce the laws to prevent the sale of that, and maintain a high tariff on pure liquors, and it will become an expensive proceeding to get irresponsibly drunk.

ABOUT GRAVESTONES.

We have just received a volume containing seventy-four lithographed designs for gravestones, accompanied by a note from the publishers to the effect that the book is regarded "as the best modern work on the subject." It is a small volume, and the price is eight dollars, for which sum one might reasonably expect to obtain something new and valuable. The work is no doubt modern, but we fail to discover anything new or especially attractive in the designs. It seems to us—and the idea is one we have long held—that it is about time that a reform in our churchyard architecture was set afoot. We have got into a rut, so to speak, of designs which have been the same from the period "whereof the memory of man runneth not to the contrary." The visitor to the country churchyard, or our magnificent Greenwood, finds them at every turn; and he may depart with the fixed impression that, when gravestone makers emancipated themselves from slabs and tables, the sole decoration of which was the occasional hourglass or impossible cherubic head, they proceeded as far as the funeral urn and broken pillar and there stopped, a few bolder spirits only advancing to the further point of crouching lambs and kneeling angels. Now, these ideas are well enough in their way, or rather they were so, say fifty years ago, when we built our houses like Grecian temples and indulged in other architectural atrocities; but at the present time, we may truthfully assert that our graveyards possess a full supply of them, and that something new would be a gratifying change.

It is needless to state that we opened the book above referred to with these feelings. We need not picture our dismay when nineteen monuments with funeral urns and five with broken pillars met our gaze; and there was the inevitable lamb, and the invariable angel in the usual uncomfortable position which it makes our bones ache to contemplate. There was not a design which seemed to us to offer any striking originality, save one, and that was a most incomprehensible combination of a ewer and basin perched on a slab. What connection existed in the designer's mind between those indispensable toilet utensils and the grave, we should much like to have explained. Some of the gravestones depicted are above average merit; but the stigma of conventionality is upon every one of them. The designers doubtless think they know the public demand, and aim to supply it in the best possible way; and the public taste and judgment perpetuates these trite conceptions, to the exclusion of the new and beautiful designs which an art knowledge, far more advanced than that which originally evolved the former, is capable of producing. We do not refer to lofty and magnificent monuments erected without regard to outlay, because such always are the work of the artist-sculptor and not of the gravestone maker, but to the humbler memorials which mark the thousands of graves in our cities of the dead. There is an abundant opportunity for the application of the principles of true taste and art feeling to these as to the more pretentious piles; and while we are making Nature transform our great cemeteries into beautiful parks and gardens, it would be well if we allowed art to produce forms which would harmonize, and not disagreeably contrast, with Nature's handiwork. Ancient mythology and the tombs and relics of the Old World abound in appropriate emblems which might find more place on the modern gravestones than they now do. What architect or artist will strike out in a new and original line of thought, and give us something better than the upright slab, pillar, or obelisk for marking the graves of the dead?

HELPING INVENTORS.

A co-operative movement, based on the English system first started at Rochdale, has been begun in Indiana and other western States. The organization is on the masonic plan, there being a "Grand Guild" and subordinate "Guilds," the latter of which have for their object apparently the promotion of co-operative enterprises of any legitimate character. Among other schemes, that of an inventors' union has been projected, whereby inventors are assisted in preparing their devices, a workshop is provided, and other encouragement afforded.

We are of course heartily in favor of any plan which tends to develop invention; but the inventors' union scheme is a very bad one, and it has been many times unsuccessfully tried. There never was and never can be a community of interest among inventors, except so far as all are interested, more than the average run of people, in general progress. The very nature of the inventor's work impels him to keep it out of public notice until it is completed, and his right in it secured to him. There are abundant circumstances under which it might be highly disadvantageous to an inventor's interest for his neighbor to gain a knowledge of his invention; and there are not many inventors who would risk making their models in a co-operative workshop, no matter to what pledges of secrecy other occupants of the room had been committed. Besides, this is not the kind of help our inventors want. In many cases of invention, not only is something originated but the implements for its production must also be contrived. It is impossible to foresee what particular means inventors will use to put their ideas in practical form; and it is useless to attempt to fit up a special shop for that purpose. The needs of inventors are, first, suggestions of devices required, and information of what others are doing or have done in the way of origination or improvement: in brief, ideas which will keep their minds in a channel which is likely to end in their conceiving some object on which to exercise their genius. Afterwards, after the patent is secured, and the inventor has perfected his device, then he sometimes needs assistance to aid in its introduction. Now the "Guilds" can furnish either class of help we have indicated, and do good; but we do not believe that they will ever earn much gratitude from inventors by fitting up a shop and requesting people to come in there and invent. They would find that good reading rooms—such as we have frequently advocated, and which have been successfully established in many places in accordance with our suggestions—will attract thinking people; and if an abundance of mechanical books and papers are provided, and discussion on new mechanical and industrial subjects encouraged, inventions will speedily follow. As regards assisting inventors in introducing their devices, there is no lack of opportunity; but the guild's part in securing the aid could hardly extend beyond bringing investors and inventors into communication. It is useless to attempt to organize an association which undertakes to push any or all the inventions of its members. Discrimination will be found necessary; and as a rule, it is about as easy to convince an inventor that his device is not of superior merit as it is to convince a mother that her baby is not handsome.

We are glad to hear of the existence of the guilds, and can commend their motive in endeavoring to help inventors. But we think that, after a little experience, they will agree with us that it is better for them to furnish means for obtaining ideas, and to leave the inventors to work out the projects based thereon after their own fashion.

LIGHTNING RODS.

A correspondent of the *Country Gentleman* writes to the editor of that paper as follows:

"Having read the recent article in your journal relative to lightning rods, I venture to propound the following inquiries: Given a large building, say a church with spire, the spire covered with tin and painted, the church roofed with slate, valleys of copper and conductors of tin, a rod with points soldered to the tin roof, the latter connected by strips of copper soldered to the copper valleys, the tin conductors connected by strips or rods of copper from the bottom with permanent moisture underground—is the building protected against lightning? (1) Would the building be better protected if the above conductors were attached in the building to the gas pipes? (2) Does the paint on one side of the tin materially reduce its power of conduction? (3) Is it not an accepted theory that the closer the rods are attached to a building the better? (4) Do you approve of the method used for protection of the Centennial buildings, as explained in the *SCIENTIFIC AMERICAN* of about a month since? (5).

W. H. G.

To which the editor of the *Country Gentleman* replies:

1. We do not perceive why this would not make a good connection throughout, and afford ample protection. The different connections might be more liable to become detached in the lapse of years than a firm rod, and would need looking to. In case the points above should prove insufficient to carry off silently the fluid from a heavily charged cloud immediately above, and there should be an explosion (a rare occurrence in such a case), there would be more liability to injure the building than if the rod were a foot or two distant from the building. 2. Gas pipes, well connected, would make good conductors, with the same liability as that just mentioned. 3. Paint does not reduce the conducting power. 4. It is better that the rod be a short distance off from the building, for the reason already explained. 5. We do not know the mode adopted on the Centennial buildings, and have not the paper referred to at hand.

REMARKS UPON THE ABOVE ANSWERS.—(1) We coincide substantially with the *Country Gentleman* in respect to the general sufficiency of the above example of protection. The proposed connections above ground are correct; but if there is any deficiency, it is in the underground connections. The terminal metal of the rod, placed underground, in contact with moist earth, should be as extensive in area as possible.

We think it erroneous to suppose that lightning rods are a means of silently discharging the electricity of thunder clouds. The latter are generally more than half a mile distant above the earth when the discharge takes place; and while a properly arranged rod, if struck, will conduct the electricity safely to ground, the sudden leap of the lightning through this air space to the rod sets the air into tremendous vibration, producing sounds like the roaring of artillery. Only the atmospheric electricity, close to the surface of the earth, is conducted to the ground silently by rods, buildings, trees, etc.

The object of the rod being to conduct off electricity from the building to earth, the rod should consequently be placed in close contact with the building, so that the electricity may easily reach it; the rod should not be separated a foot or two, as our contemporary suggests; the explosion he refers to is the crashing noise, which the rod can neither cause nor prevent.

(2) The protection of the building would be improved if the conductors were attached, in the building, to the gas pipes. But the attachment of the foot of the rod to the gas pipes, outside of the building, would be more convenient—these connections to be additional to the large metallic terminals in moist earth, before mentioned.

As to inside gas pipes, they are good conductors, and all that is necessary is to bridge over the space between the street pipe and house pipe, occupied by the meter and its lead pipe, with copper wires. The lead pipe is a poor conductor. By using the copper bridge, if the gas pipes in the house are struck, the electricity will pass off into the earth.

(3) We agree with our contemporary.

(4) It is an accepted theory that the closer the rods are attached to the building the better. The reply of our contemporary is incorrect, for the reason explained under (1).

(5) The mode adopted on the Centennial buildings was to connect the metallic roofs with the earth, by means of numerous rods soldered at different points to the roof, and carried directly down into the ground, and there soldered to the extensive system of eight inch underground water pipes. Thus the rods had the closest possible connection with the roof: while the earth terminals of the rods were provided with a very large area of conducting material placed underground—which latter is the essential thing necessary to render any rod a protection; but is the very thing that the majority of people neglect in rodding their buildings.

Fulton's Account of the First Steamboat Trip between New York and Albany.

In the *Suffolk Gazette*, printed at Sag Harbor, on the east end of Long Island, October 12, 1807, is a letter from Robert Fulton to Joel Barlow, giving an account of the first trip of the first steamboat on the Hudson River. It is as follows:

TO JOEL BARLOW, PHILADELPHIA.

NEW YORK, 22d Aug., 1807.

MY DEAR FRIEND: My steamboat voyage to Albany and back has turned out rather more favorable than I had calculated. The distance from New York to Albany is 150 miles; I ran it up in 32 hours and down in 30 hours. The latter is just 5 miles an hour. I had a light breeze against me the whole way going and coming, so that no use was made of my sails; and the voyage has been performed wholly by the power of the steam engine. I overtook many sloops and schooners bearing to windward, and passed them as if they had been at anchor.

The power of propelling boats by steam is now fully

proved. The morning I left New York there were not perhaps thirty persons in the city who believed that the boat would ever move one mile an hour or be of the least utility. And while we were putting off from the wharf, which was crowded with spectators, I heard a number of sarcastic remarks; this is the way you know in which ignorant men compliment what they call philosophers and projectors.

Having employed much time and money and zeal in accomplishing this work, it gives me, as it will you, great pleasure to see it so fully answer my expectations. It will give a quick and cheap conveyance to merchandise on the Mississippi, Missouri, and other great rivers which are now laying open their treasures to the enterprise of our countrymen. And although the prospect of personal emolument has been some inducement to me, yet I feel infinitely more pleasure in reflecting with you on the immense advantage that my country will derive from the invention.

However, I will not admit that it is half so important as the Torpedo system of defence and attack; for out of this will grow the liberty of the seas; an object of infinite importance to the welfare of America and every civilized country. But thousands of witnesses have now seen the steamboat in rapid movement, and they believe—but they have not seen a ship of war destroyed by a torpedo, and they do not believe. We cannot expect people in general to have a knowledge of physics, or power of mind sufficient to combine ideas and reason from causes to effects. But in case we have war, and the enemy's ships come into our water, if the government will give me reasonable means of action, I will soon convince the world that we have surer and cheaper modes of defence than they are aware of.

Yours, etc.,

ROBERT FULTON.

Transparent Gold.

In the course of a lecture on gold, delivered before the Franklin Institute, on February 27th last, Mr. A. E. Outerbridge, Jr., of the Assay Department of the Mint in Philadelphia, Pa., gave an account of some experiments he had made, with the view of ascertaining how thin a film of gold was necessary to produce a fine gold color.

The plan adopted was as follows: From a sheet of copper rolled down to a thickness of $\frac{1}{1000}$ of an inch he cut a strip $2\frac{1}{2}$ by 4 inches. This strip, containing 20 square inches of surface, after being carefully cleaned and burnished, was weighed on a delicate assay balance. Sufficient gold to produce a fine gold color was then deposited on it by means of the battery; the strip was then dried without rubbing, and re-weighed, and found to have gained one tenth of a grain, thus showing that one grain of gold can, by this method, be made to cover 200 square inches, as compared to 75 square inches by beating. By calculation, based on the weight of a cubic inch of pure gold, the thickness of the deposited film was ascertained to be $\frac{1}{1000}$ of an inch, as against $\frac{1}{1000}$ for the beaten film. An examination under the microscope showed the film to be continuous and not deposited in spots, the whole surface presenting the appearance of pure gold. Not being satisfied, however, with this proof, and desiring to examine the film by transmitted light, Mr. Outerbridge has since tried several methods for separating the film from the copper, and the following one has proved entirely successful:

The gold plating was removed from one side of the copper strip, and by immersing small pieces in weak nitric acid for several days, the copper was entirely dissolved, leaving the films of gold intact, floating on the surface of the liquid. Three were collected on strips of glass, to which they adhere on drying, and the image of one of them was projected on the screen by means of the gas microscope. It was observed that it was entirely continuous, of the characteristic bright green color, and very transparent, as was shown by placing a slide of diatoms behind the film. By changing the position of the instrument, and throwing the image of the film on the screen by means of reflected light, its true gold color was seen. Mr. Outerbridge has continued his experiments, and, by the same processes, has succeeded in producing continuous films, which he determined to be only the 1 two million seven hundred and ninety-eight thousandth ($\frac{1}{2,798,000}$) of an inch in thickness, or ten thousand five hundred and eighty-four (10,584) times thinner than an ordinary sheet of printing paper, or sixty (60) times less than a single undulation of green light. The weight of gold covering 20 square inches is, in this case, thirty-five thousandths ($\frac{35}{1000}$) of a grain: one grain being sufficient to cover nearly 4 square feet of copper. The film is perfectly transparent and continuous, even in thickness, and presents all the characteristics of the one shown before. That a portion of the image appears darker is due to superposed films, the intensity of the green color being proportioned to the thickness through which the light passes.

Riches and Reason.

The experience of the late Mr. John Daly, of this city, who got riches but lost his reason and committed suicide, points a moral for our time. The case of Dr. Ayer, the well known millionaire, who is in an asylum for the insane, furnishes a commentary on the failure which some men are making by their appetite for money. There are scores of similar cases of insanity caused by a too intense application to business. Brains are of more account than bank notes, even in this world, truthfully says the *Christian at Work*, and it is never wise to risk one's head to accumulate a property for other people to quarrel over.

IMPROVED DIAGONAL PLANING AND POLISHING MACHINE.

The accompanying engraving represents one form of Norris' diagonal planing and polishing machine, which is a Woodworth planing machine of the raising and lowering bed class, and of improved construction. The cutting cylinder is made to be changed, at will, from its usual position of square across the machine, to a diagonal one of 35°, and vice versa. A polishing device is also provided which, when suitably adjusted, polishes the surface of the material after the latter has passed the planing cylinder. Among the advantages claimed is that, when smoother surfaces than can ordinarily be produced by planing machines are required, the cylinder can be instantly swung into the diagonal position, and the polishing device thrown into gear; rough lumber fed in then emerges with the surface planed and polished, ready for paint, oil, or varnish. With the cylinder working diagonally, all kinds of framed articles, such as doors, sashes, blinds, ends of bureaus, commodes, desks, cabinet organs, etc., are claimed to be planed, as easily, perfectly, and cheaply as common lumber, and with the polishing device in operation they are polished perfectly at the same time. The manufacturer states that two men are enabled to do the work of twenty skilled men with hand tools, and at the same time make better surfaces. The machine is adapted for the uses of carpenters' and joiners' shops, sash, blind, and door factories, cabinet-makers' shops, cabinet organ, furniture, railroad, and street car factories, whether large or small, using the cylinder square across for ordinary surfacing, and diagonally for smooth planing and where flat frame work is to be smoothed.

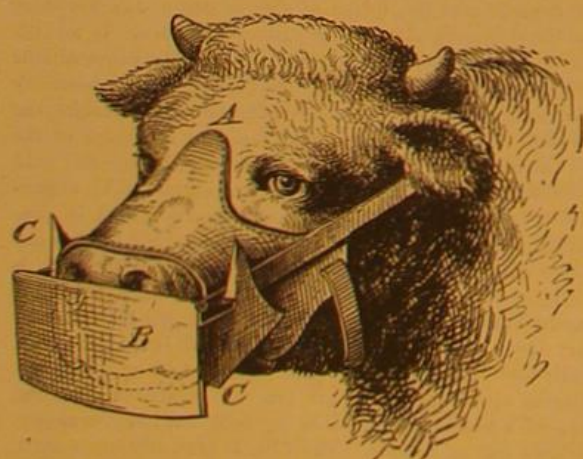
Nearly fifty of Mr. Norris' machines are, we are informed, in use in the sash, blind, and door factories of the United States and Canada. The machine from which the annexed engraving was prepared is in use in the largest walnut furniture factory in this city.

Further information may be obtained by addressing W. R. Norris, Fort Ann, N. Y. Arrangements for the manufacture of these machines in Canada are desired.

IMPROVED CALF MUZZLE.

Mr. August Miller, of Salina, Kansas, has patented, January 18, 1876, a muzzle for calves, by which they can be effectively prevented from sucking the cows when in the same inclosure with them, without being hindered from grazing or getting other food. The muzzle may also be used for dogs and other animals with advantage.

In the engraving, A represents a rigid frame, made of a solid or full-top part, of zinc or other material, that is fitted on the nose of the calf or other animal to protect the same against getting chafed or sore. The top plate is fastened thereto by a flexible head strap, *a*, and a lower jaw strap, *b*. A swinging guard plate, B, is hinged to the front edge of the full-top frame, A, and it extends fully across the front of the mouth. The guard plate has at both sides hinged plates or boards, C, with projecting spur-shaped rear and top extensions, *d*, that serve to hurt the cow when the calf attempts to suck, so that it is driven off and prevented from taking hold of the teat. The front and side guard plates close over the mouth on the upward motion of the calf's

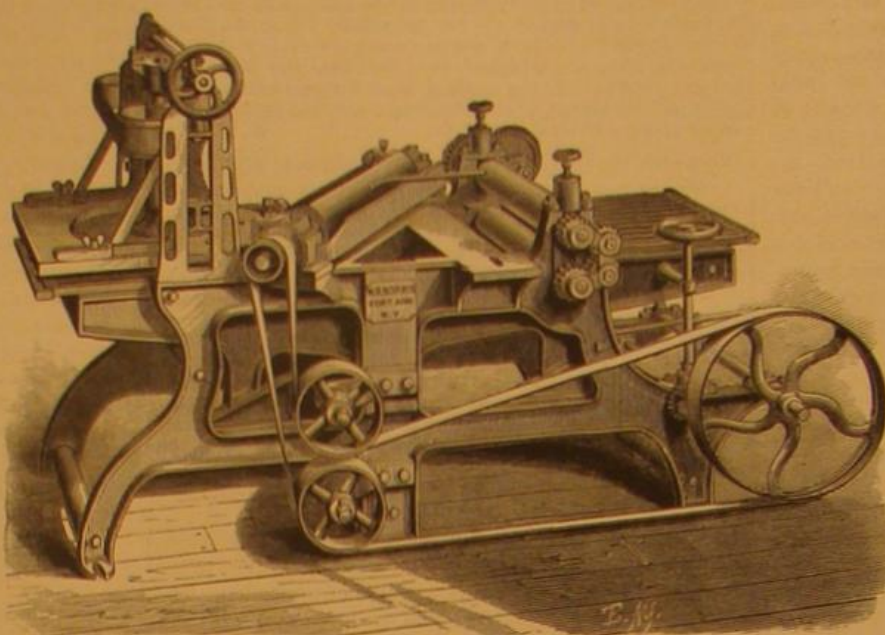


head, but do not interfere with the grazing or other feeding when the head is in downward position, as the plates swing away from the nose and admit the free use of the mouth. The side plates, C, are provided at the top spur, *d*, with inwardly projecting catches, *e*, that engage the side flanges, *f*, of the top frame when the calf turns one side up to get the teat into the corner of the mouth. The side plate is thereby locked to the frame and shuts out the teat, securing at the same time the position of the front guard plate, so that the same cannot be swung higher by the jerks of the animal's head when trying to get the teat.

A Simple Test for Carbonic Oxide.

All previous methods for estimating or detecting carbonic oxide by oxidizing it with chromic acid, absorbing it in subchloride of copper, or reducing palladium solutions, are tedious and difficult. Professor H. W. Vogel has turned

his favorite weapon, the spectroscope, against this, and again brought down his game. The reagent which he employs to absorb the carbonic oxide is simply blood and water. This mixture is so dilute as to have only a faint red tinge, and, when placed in an absorption cell, 1.8 to 2.5 inches thick, shows distinctly the well known absorption bands. In testing the air of a room for carbonic oxide, he takes a bottle that will hold 100 cubic centimeters, fills it with water, and then empties it in the room where the test is to be made. Of course, as the water flows out, the suspected air rushes in to fill the bottle. About 2 cubic centimeters



NORRIS' PLANING AND POLISHING MACHINE.

($\frac{1}{4}$ cubic inch) of the diluted blood is poured in, and the bottle shaken for one minute only. The color of the blood changes, it looks more pink, the absorption bands are a little paler and pressed a little back to the left or end of the spectrum. A skilled spectroscopist would notice this at once; but for the less experienced, Professor Vogel adds 3 or 4 drops of strong sulphide of ammonium. If the blood is free from carbonic acid, the two bands near D and E disappear, and a broad faint band appears between where these were; but if carbonic oxide be present, these bands remain unchanged, when the sulphide of ammonium is added.

To test the delicacy of this reaction, Dr. Vogel took the usual mixture of carbonic acid and oxide, as obtained by the action of sulphuric acid on oxalic acid, and mixed it with 60 volumes of atmospheric air, and by shaking two minutes with 2 cubic centimeters of the blood solution, the reaction was very unmistakable. As little as 0.4 per cent of carbonic oxide in the atmosphere can be detected in this way by taking 500 cubic centimeters (about 1 pint) of the air and shaking with 3 cubic centimeters of dilute blood. The quantity of blood required is so small that Dr. Vogel suggests that the experimenter can draw it from himself, or fresh blood can be kept in the laboratory for a week by the use of salicylic acid. The reaction could be rendered more delicate if the oxygen were removed. Carbonic acid is readily detected in this way in tobacco smoke and in illuminating gas.

New Copying Ink.

The best kinds of copying ink are usually prepared by adding a few per cent of alum to an extract of logwood of 10° B., or to a decoction of the same; and then, to improve its copying power, some sugar and glycerin, or table salt is added. Such inks have a violet tint, are purple when first written with, and gradually darken on the paper. The copies taken from them are at first very pale, and only slowly darken.

Professor Gintl states that a new kind of Parisian copying ink has been recently introduced into Germany, which differs from those previously in use in having, while liquid, a more or less yellowish red color; but on paper it rapidly turns blue, and immediately produces a distinct blue-black copying ink. Moreover, it remains liquid a long time; while ordinarily violet copying ink soon gets thick and has sediment in it; this kind copies easily and perfectly.

Experiments and attempts to make this ink lead to the following result, which indicates the method of its manufacture: A logwood extract of 10° B. has added to it 1 per cent of alum, and then enough lime water to form a permanent precipitate. This mass is then treated with a few drops of a dilute solution of chloride of lime (bleaching powder), just enough being added to impart to it a distinct blue-black color, after which dilute muriatic acid is added drop by drop until a distinctly red colored solution is produced. To this solution is added a little gum, and a half of 1 per cent of glycerin. The preparation thus obtained has all the properties of the Parisian copying ink. It is evident that the small quantity of chloride of calcium, formed by this process, greatly increases the copying power of the ink; while the exceedingly slight excess of free hydrochloric acid causes the ink to remain liquid by holding in solution the lime and alumina lakes of logwood. When the writing dries, the acid gradually escapes or is neutralized by the trace of alkali in the paper, so that the blue-black lake is left. It is evident

that any considerable excess of muriatic acid must be avoided, as also the use of too much chloride of lime solution.—*Deutsche Industrie Zeitung.*

Heated Air Instead of Oxygen in the Lime Light.

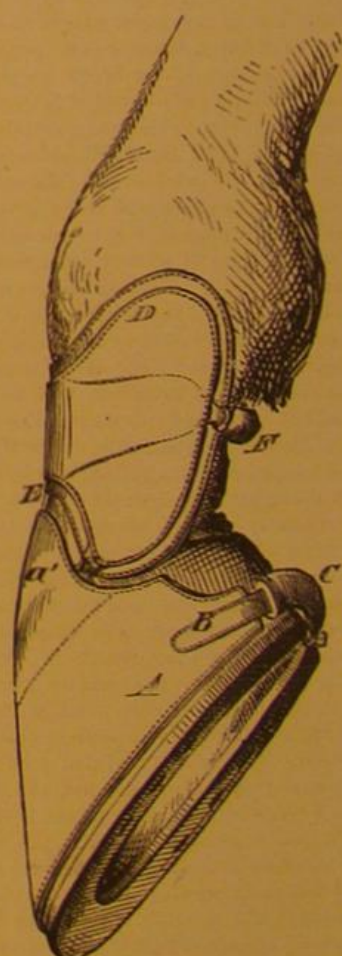
Means of producing artificial light of good actinic quality at a moderate cost, without risk of explosion or other danger, must always interest photographers, and many and various experiments made from time to time have been brought under the attention of our readers. The oxyhydrogen light has, of course, satisfied the condition of efficiency; but besides the cost of oxygen there has been the greater objection of risk in its preparation, storage, and use. Mr. Woodbury has recently been good enough to bring under our attention the result of some experiments, by which he hopes to obtain a light, in all respects efficient for lantern purposes and for enlargement, in which, whilst obtaining the brilliancy and the purity of incandescent lime, he dispenses entirely with oxygen in obtaining it.

Mr. Woodbury does not claim to have invented a new thing, but he has made a valuable application of an existing thing. Some of our readers may be familiar with the Fletcher blowpipe, in which a jet of heated air, inside a gas jet, emerges at the same orifice as the gas, into the flame of which it enters, producing an intensely hot concentrated flame. This constitutes the Fletcher blowpipe. The air pipe is connected with an air bag, sending a stream of air through it, finally entering a spiral tube, which twines round the gasburner, both being heated by a Bunsen burner underneath. The intense jet to which we have referred is made by Mr. Woodbury to play upon a lime cylinder, by which is produced a concentrated flame of very intense brilliancy and pure actinic color, admirably suited alike for the sciopicon or other magic lantern, and for photographic enlarging purposes.—*London Photographic News.*

IMPROVED HORSE BOOT.

Mr. Joseph Fennell, of Cynthiana, Ky., has patented through the Scientific American Patent Agency, March 31, 1876, an improved boot, which is herewith illustrated. It is designed to protect the hoof, pastern joint, and fetlock joint from being cut or injured by the overreaching or interfering of the horse when being driven at high speed, and is so constructed as not to chafe or stiffen the joints or confine or cord the leg. It allows sand to pass out readily.

A is the lower or hoof boot, which is so formed as to cover the hoof, to which it is secured by a strap, B, buckled tightly around the heel of the hoof just above the shoe. Upon the strap, B, is placed a rubber tube, C, four inches, more or less, in length, which prevents the strap, B, from slipping. The forward part, *a'*, of the boot, A, is extended upward to cover and protect the corona of the hoof and the pastern joint, which extension, *a'*, is padded to prevent it from chafing the said joint. D is the upper or speedy-cut boot, the lower edge of which is concaved to correspond with the extension, *a'*, of the hoof boot, A, and is connected with the upper edge of said boot, A, by two or more flexible straps, E, so that the boot may not interfere with the proper play of the joints. The boot, D, is secured in place by a small strap, F, buckled around the fetlock, and which is only designed to keep the boot, E, from falling down. The strap, F, is padded, and buckled loosely, so that it cannot chafe or cord the leg. The boot, E, is padded upon the inner side, and is made flaring both upward and downward, so that it cannot confine the sand, but will allow it to pass out freely.



PURIFICATION OF BISMUTH.—M. E. Smith adds to 16 parts of bismuth, kept in fusion at the lowest possible temperature, 1 part of a mixture of 8 parts of cyanide of potassium and 3 parts flowers of sulphur. After fifteen minutes the metal is allowed to cool.

PRACTICAL MECHANISM.

BY JOSHUA ROSE.

NEW SERIES—No. XXVIII.

PATTERN MAKING.—BEVEL WHEELS.

"He who can make a good bevel wheel is a good pattern maker." That was once the saying; but the system that divides a trade into specialties is now growing to be the general custom, and it has robbed the expression of half its truth, for there are many good pattern makers who have been engaged all their lives in specialties remote from bevel wheel making. We give the saying, however, merely to show the importance that has always been attached to work of this kind, not undeservedly. A pair of bevel wheel patterns, fresh from the workman's hand, especially if of mahogany and nicely varnished, excite general admiration. It is a job easy enough to do; but you must know the way: that way is what I shall endeavor to elucidate.

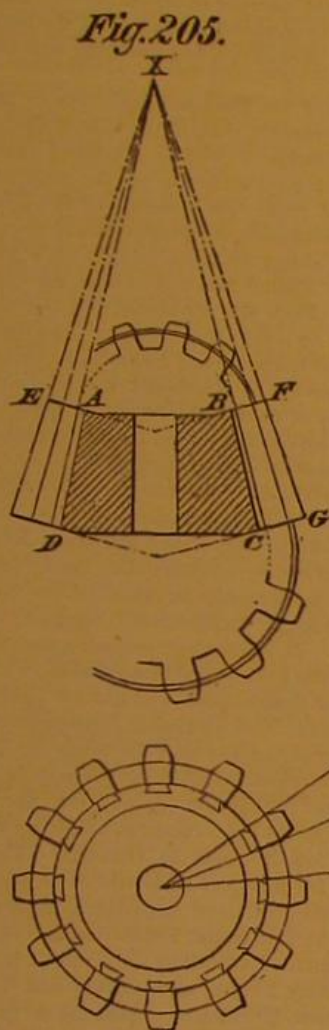


Fig. 205 is a sectional elevation and plan of a bevel pinion; the construction of the body does not differ materially from that of a spur. We may commence building up, if the pinion is of such size to require building, from the small side, A B, for the reason that it is desirable and convenient to turn the part, where the teeth are to be, last, when the building is completed; or if it is a solid piece, we begin by turning off to the line, D C, then reverse on the chuck and turn A B, making a slight recess for the core pivot, set a bevel to the angle, A B C, on the drawing, and turn the circumference to it and at the same time to the required diameter, making it perfectly true and straight for the reception of the teeth. Very little, if any, sandpapering is to be done on this part; it destroys the evenness of the surface. With a fine tracing point, and while the lathe is in motion, mark a line near to D C on the circumference, or, properly speaking, the face. Upon this line the pitching or dividing is made to determine the position of the teeth; divide this line into as many parts as it is desired to have teeth. It often happens in performing this division that, having passed the compasses around the piece, we do not fall exactly into the starting point, but yet are so near that we cannot shift the compasses, even if they are furnished with a slow-motion screw, without making the error greater. The usual way of overcoming this difficulty is to give the compass points a few slight rubs upon the oilstone inside or out, according as we wish either to enlarge or diminish the distance between them.

When a pair of bevel gears are geared together, all the teeth on each wheel incline towards a single point; this point is where the axial lines of the shafts would meet if produced. In order to give this direction to the teeth of a bevel wheel or pinion, we must set them square; but to an article of the shape we have produced, an ordinary square cannot be applied in this case, and the workman calls to his aid one of the simplest problems in practical geometry, namely, to erect a perpendicular to a given line. This is illustrated in Fig. 206, where the whole outline is supposed to represent the turned body of the pinion. A B is the line passing around it, of which we have previously spoken. In it take any point, C; it may be one of the points already made in pitching off. With C as a center, and at any distance convenient, mark D and E; with D and E as centers, and at any suitable distance, mark the arcs which intersect at the

point, F. Join F C; it is the perpendicular line required. As it would be too troublesome to go through this operation for

Fig. 206.

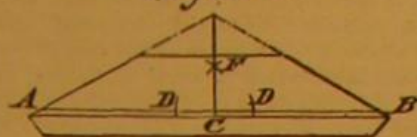


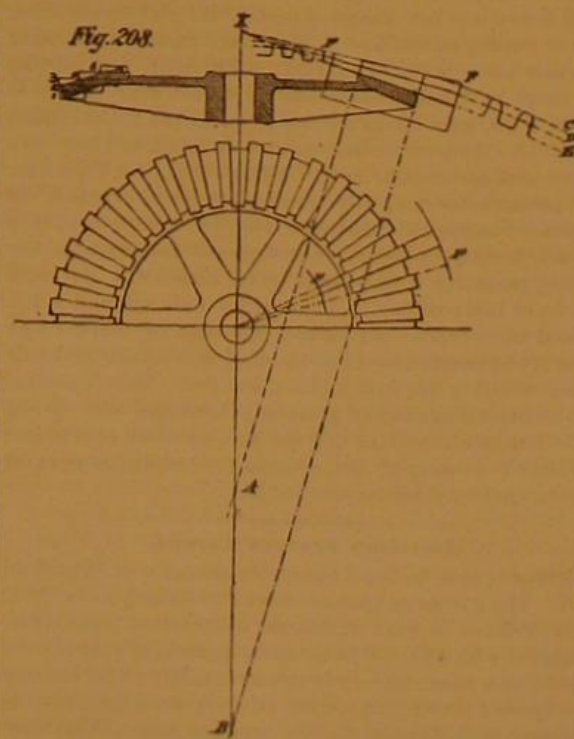
Fig. 207.



every tooth on the wheel or pinion, a square has to be made, such as shown in Fig. 207; the back is generally a piece of pine gauged to fit the edge of the rim or face; a hard wood blade is screwed to it, so that, when the back is applied to the rim, the blade may be made to coincide with the perpendicular line, F C; all the rest of the perpendiculars required at the points of division are traced by this square. Another method even more simple is to plane a piece of thin wood to lie upon the hand-rest of the lathe, so as at the same time to coincide with the perpendicular drawn by the aid of the compasses; it is then correct for tracing the others. This arrangement is shown in Fig. 209.

If we intend simply to glue and brad the teeth, we proceed to make blocks, a little larger every way than the teeth require to be, hollowing out one side to fit the cone of the body of the pinion. These blocks are glued on to the lines; and when the work is set, it is returned, this time setting the bevel to the angle, E F G. A pitch line must be traced on each side; redivide and draw in the outline of the teeth on the larger side; then, by the methods already described for making perpendiculars, transfer the points of the teeth to the small side; then complete the outline, following out the same principle adopted in tracing the large side: that is to say, taking corresponding centers and distances proportionate to the diminished size of the small side of the cone, as shown in Fig. 205, where the large and small ends of three teeth are set out.

When the subject of spur pinions was under consideration, I deferred making any remarks upon the attachment of teeth by dovetails until bevel gear should be treated on; let us now consider the advantages and disadvantages, if any, of this mode of fixing the teeth. We have long ago mentioned the property which wood has of altering its size according to the dryness or humidity of the atmosphere, which

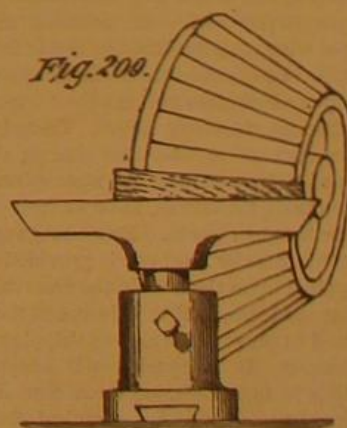


alteration, though considerable across the grain, is very slight in the direction of its length. Hence, when teeth are glued to a body, the grain of which crosses that of the teeth, there will be a movement between the two when the pattern is subjected to a change in dampness or dryness; the dovetail allows freedom for any movement from these causes, retaining the tooth in its position under all circumstances. Should the mould happen to break down in the act of withdrawing the pattern, it may be restored to a considerable extent by knocking out a few teeth, placing them in the damaged impressions left by the pattern, and bedding up the sand around them. It sometimes happens that the teeth of a

bevel wheel or pinion will be too much undercut to leave the mould without damaging it; this method will admit of the teeth being withdrawn in detail, after which the pattern can be lifted without difficulty. To counterbalance these advantages must be mentioned the extra cost inseparable from this method of fixing the teeth. This, however, is really a small matter when dealing with pinions; and therefore bevel pinions usually have their teeth attached by dovetails, excepting those of small size. If it is decided to use dovetails, we proceed as follows: The body of the pinion has been turned and divided, and the perpendiculars all finely drawn in. Cut out of thin wood a piece of the size which the dovetails are intended to be, which is such that a small margin of tooth may be left on each side; set the piece on the rim, at a distance from a perpendicular equal to the margin allowed; set it by the square shown in Fig. 207, as the dovetail must have such a taper that its sides may both tend towards the point, X, before alluded to, namely, the intersection of the axes of the shafts. This will be the case if, when one side of the dovetail template has been set square, the other is square also. By this template, lines for all the dovetails are scribed on the face; the depth is laid off on the drawing by lines tending toward X; and from this the depth of each end of the recess may be gauged on the pattern. No curvature is given to the bottom of this; it is pared out flat with the chisel; the dovetails are now fitted, and left projecting above the face; they are driven moderately tight; the projecting parts are then turned off level with the rim.

We have now to go through the same process as before described for making and attaching teeth. When the glue is well set, each should be knocked out, numbered, and the dovetail bradded. Fig. 208 is a section and half plan of a bevel wheel; in the latter the shape of the teeth is not shown, but merely their thickness at the pitch line; in the sectional view, a few teeth are laid out in profile upon arcs struck from the centers, A and B, which are the points of intersection of perpendiculars from the ends of the teeth (at the pitch line) and the center line. In the section on one side is shown a series of rectangles numbered from 1 to 5; these represent the segments of which the rim is composed. It is true that they might be made more nearly to approximate to the shape of the rim by sawing them to a bevel, but a machine suitable for this is not in every shop; and when it is considered that the segments themselves are usually not more than $\frac{1}{8}$ inch in thickness, it will be seen that the additional complication counterbalances the saving in lumber and time in turning. If, however, the wheel is very large, or where thick segments are employed, we may advantageously saw the segments to a bevel. The method described for turning the bevel pinion is exactly suitable for the wheel; the arms will be checked together, but need not be built into the rim, unless we desire an exceptionally strong pattern; the obliquity of the rim enables us to get a good purchase, by means of screws through the end of each arm into it. Care must be taken to have the ends of the arms each to bear properly on the rim; otherwise the rim will be thrown out of true in screwing.

It will be remembered that, in treating upon the spur wheel, we had, in forming the box for shaping the teeth, simply to draw out on each end the natural size of the tooth, that is, if we except a slight diminution towards one end for draught; but the conical form of a bevel wheel gives a little extra trouble. In Fig. 208 the tooth proper is of the length of the face of the wheel, as seen in section. Now all lines



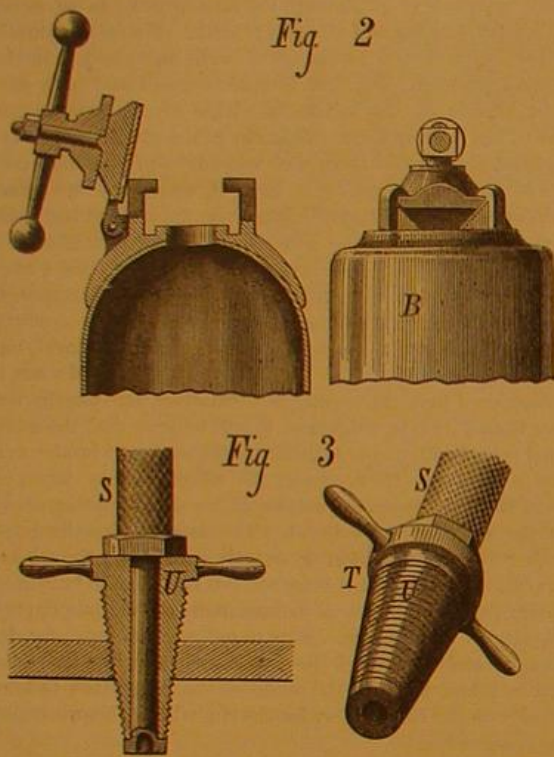
bounding the teeth must converge to the point, X; so if we take F F to represent the length of the box, we must strike out upon the large end an enlarged, and upon the small end a diminished, tooth; then by planing to these lines we shall have formed such a box that any piece shaped in the gap formed in it will be of the proper size and shape for a tooth. It would confuse our engraving too much were we to attempt to show the enlarged and diminished tooth on the ends of the box; but the principle is easily understood, as we have but to follow out whatever method has been adopted on the drawing for producing the tooth curves. It will be necessary to recur to this subject again when treating specially upon the methods of tracing out the curves suitable for teeth.

SINCE the first of the year New York has exported over 70,000,000 gallons of petroleum against 25,000,000 by all other ports. Last year the city had only about half the trade.

[Continued from first page.]

the apparatus to act so as to drive the liquid up into the other parts. This is done by a simple adjustment of valves and connections which need not here be explained. Steam may also be conducted to the acid reservoir to serve the same purpose. A water trap, O, is provided in the air pump pipe, which prevents the acid fumes from injuriously affecting the working parts of the pump. The pipes, P, connecting the domes with the chargers, serve to equalize the pressure between the two, and to permit the free passage of the acid down to the generator, when the chemicals are to be mixed, by preventing a vacuum above the acid. Each dome, by means of a horizontal distributing pipe, Q, with suitable vertical branches, communicates with the gas holder or purifier, R, into which the generated gas is thus conducted. The purifier is a cylindrical vessel, which is imperforate at the points where the entering gas strikes it in issuing from the branch pipes; and between these pipes it is perforated to admit the passage of the gas. The object of this partition is to eliminate the solid and liquid particles which are mechanically carried up on the form of spray, by causing them to impinge against the imperforate portion of the diaphragms. The gas then passes to the hose, S.

In order to remove the collected impurities from the purifier, a pipe, with suitable valve, leads from the bottom thereof to the discharge pipe, G. In this way, water may be led in from the main supply, E, and also discharged through the same pipe. The latter also serves as a drain for any of the liquid contents of the generator which might surge up into



GRANGER'S APPARATUS FOR EXTINGUISHING FIRE ON SHIPBOARD.—Figs. 2 and 3.

the holder; and thus it operates as an equalizer to restore the said liquid to the generators. In order to introduce the gas into the burning vessel, without causing it to entrain air with it, the nozzle, T, Fig. 3, has a tapered screw-threaded swivelling sleeve, U, which is provided with handles, and which may be screwed into a hole of any size bored in the deck. An attendant at the nozzle is thus dispensed with, and the latter is firmly held airtight. An extra pipe, V, is connected to the distributing pipe, and leads into the open air so as to prevent the escape of the gas into the room through the safety valves. There is a separate safety valve on each dome, and also one on the purifier, which is arranged to blow off into the atmosphere at a lower pressure than those on the domes, in order to insure that no gas shall escape between decks. Pressure gauges are also arranged on each generator, and one is provided to indicate the pressure applied upon the acid in the reservoir.

The apparatus, we learn, is already in use on the Protector, a vessel now used to prevent fire among shipping in the harbor of New Orleans. It is equally well adapted for use aboard the ship it is to protect, or upon a small vessel, as above noted, to serve as a floating chemical fire engine in ports. Within two months last year it was the means of extinguishing fire on three cotton-loaded vessels in the above-named harbor. These ships carried respectively 1,400, 990, and 3,200 bales of cotton, and were valued with their cargoes at an aggregate sum of \$375,000. We are informed that, with the exception of the bales of cotton which had actually been on fire, in two of the vessels the cotton, after the flames had been subdued, was discharged "in as good order and condition as it would have been at port of destination had there been no disaster." In the third vessel, water was employed by the firemen; but the fire was subdued by the gas. In one instance the flames, which were rising twenty-five feet above the hatches, were brought under control in twelve minutes after the gas had been admitted to the ship. The importance of this invention in such cases as the above is especially great; as cotton, when soaked with water, becomes much deteriorated in value. The United States Board of Inspectors examined the vessels saved. This body, in an official report, recommends the adoption of the apparatus aboard all steam vessels. We need not point out the advan-

tages of the invention to passenger-carrying ships. Even on a man-of-war, where rigid discipline prevails and where fire is provided against by an elaborate system of drill, the outbreak of a fire at sea is apt to produce a panic, as was recently the case aboard the Egyptian cruiser Latif in the Red Sea. On an ordinary ocean steamer, crowded with people, the terrible confusion can be easily imagined. Amid such a state of affairs, it is difficult to collect enough cool-headed people to aid in managing the usual appliances; and every moment of delay in getting the flames under only intensifies the general fear. In such cases the apparatus which we have described, which silently and quickly smothers the conflagration, might well prove invaluable.

Patented through the Scientific American Patent Agency, January 2, 1877. For further information, address the inventor, Mr. A. M. Granger, Exposition Building, New Orleans, La.

Preserving Metals.

For preserving metal and other substances from decay and fouling, Mr. Charles Weightman Harrison, of South Kensington, London, Eng., proposes to dissolve the crystalline hydrocarbon known as ozokerit in any of its solvents, such as benzole, petroleum, oil of turpentine, or resin oil, and he then mixes the solution in any desired proportion with other suitable bodies according to the purpose for which it is required. He mentions that his experiments have been made with ozokerit as a type of the mineral hydrocarbons, which are built up of molecules containing not less than 20 atoms of carbon, such minerals being capable of resisting the action of all acids at ordinary temperatures, and suffering no deterioration from atmospheric influences. On this account he has found them valuable for mixing with gums, resins, and colors applicable to a great variety of purposes for preserving, as they impart thereto a high degree of permanence. He explains that a simple and ready mode of preserving bright metals from rust is to rub them over occasionally with a wax formed by melting together equal parts, or nearly so, of ozokerit and beeswax. It is easily applied in a thin coat by rubbing the compound on the metal with a cloth. In applying this compound wax to iron, he sometimes adds finely powdered plumbago to give it the color of the metal. Another compound or solution for preserving metals he forms by dissolving in a sand bath (say) 4 ozs. ozokerit and 4 ozs. marine glue in 2 lbs. benzole, and then adds 4 lbs. linseed oil and $\frac{1}{4}$ lb. essence of turpentine. The mixture is kept gently boiling in the bath for an hour or so, after which it is ready for use, and may be applied to the metal by a soft brush, as in ordinary painting. In some cases he impregnates the surface of the metal deeply by forcing the compound of ozokerit into the pores by exhaustion or pressure, or the two combined. A convenient apparatus, which he uses for this purpose, consists of a metal cylinder, such as a wrought iron boiler of a suitable size and strength, equal (say) to about 200 lbs. to the square inch, fitted by connections with exhaust and pressure pumps in a manner which is well known. This cylinder is provided with an airtight door and a safety valve. When the metal articles have been placed in the cylinder, the air is exhausted to about 27 inches of mercury, and the hydrocarbon fluid is then admitted through a connecting pipe until the articles to be impregnated are covered. The pressure is then put on, and the fluid forced into the exhausted pores. He also claims painting or coating metals with a compound formed by melting together about 5 lbs. of ozokerit, 5 lbs. resin, and stirring the fluid in 2 gallons rectified spirit (65° over proof), in which 2 lbs. gum sandarach and 2 lbs. garnet lac have been dissolved. Add turpentine varnish to them, and boil at a gentle heat for an hour or so. Filter through a fine cloth, and preserve for use. He forms a protecting varnish for suspended or open air telegraph wires by coating them with a fluid, formed by mixing together and heating at a low boiling point for a short time, $\frac{1}{4}$ lb. ozokerit, $\frac{1}{4}$ lb. gutta percha or india rubber, 1 lb. rectified resin oil, and 2 lbs. linseed oil varnish. As varnish for outdoor ironwork he proposes to dissolve, in 2 lbs. tar oil, $\frac{1}{4}$ lb. ozokerit and $\frac{1}{4}$ lb. resin, mixed while hot in an open pot. The invention also includes a process of poisoning barnacles with strong tonic bitters—Angostura and the like—or weak strychnine; but these not being of direct interest to manufacturers or miners, they need not be referred to.

American Fruit in Europe.

Europe is now taking a surprising quantity of American fruit. The purchases have amounted, according to the New York Tribune, to over \$2,500,000 worth since June, 1876, compared with \$600,000 in the same period the year before. Dried apples figure largely in this movement. This country has exported over 12,000,000 lbs. of them since last June, as compared with 522,000 lbs. the previous year. This new addition to the trade of the United States is due to invention, which has occupied itself of late with improved methods for drying and preserving for transporting fruit. The greatest progress has been made in the way of dryers. Within a year some notable inventions in this line have been perfected which are a great acquisition to the resources of the country. The fruit dryer bids fair hereafter to be as much of a necessity to every farming community as the cider mill and the cheese factory.

According to the Philadelphia Trade Journal, Mr. Peabody, the inventor of the Peabody rifle, receives about \$300 a day in royalty.

Communications.

Our Washington Correspondence.

To the Editor of the Scientific American:

In my letter published in No. 22, I mentioned that S. D. Locke had applied to Secretary Schurz for an order directing the Commissioner of Patents to re-hear a case decided against the applicant by Assistant Commissioner Doolittle, which application the Secretary denied. Mr. Locke has since applied to Judge Humphreys of the District Supreme Court for a mandamus directing the Commissioner of Patents to re-hear the case. The hearing was set for May 22, but was postponed until a later day; and on the second day set, the Judge again postponed the case until the fall term.

Under a recent examination of third assistant examiners, in which seventeen competed, Messrs. C. J. Hedrick, F. S. Williams, and R. J. Fisher were appointed second assistant examiners. To fill the vacancies thus made in the ranks of the third assistants, another examination has just been held, in which sixty-five competitors took part, the result of which has not yet been announced, but probably will be before this is published.

The managers of the French Exposition of 1878 have informed our government that, if the United States is to take part in the Exhibition, it will be necessary that immediate steps be taken for representation in the American section. The Secretary of State, by direction of the President, has now under consideration the proper measures to be recommended to the Cabinet to form a basis of a plan of representation of the United States Government and people at the Exposition. Both the President and Secretary express their regret that no action was taken by Congress at the time the notification of the proposed Exhibition, submitted to the Secretary of State by M. Bartholdi, was transmitted to that body. The letter of the late Secretary of State transmitting the notification was accompanied by no recommendation of a plan of representation, on account, it is said, of the dissatisfaction entertained by the late Administration with the action of some of the French Commissioners during our own exhibition. President Hayes and Secretary Evarts, on the contrary, are extremely anxious that some representation should be had, particularly in view of the fact that the French Commissioner Sommerard's conduct was satisfactorily explained. It is thought probable that the best plan will be to appoint a Provisional Commission, with the understanding that the Commission will not be paid unless Congress, when it meets, makes suitable appropriations, and that by this means arrangements may be made for the shipment of articles by American exhibitors. There is no constitutional impediment to this course, and the Secretary thinks there will be no doubt about Congress making the necessary appropriation when it meets in October. The minimum amount wanted for this purpose is said to be about \$300,000. Several prominent gentlemen associated in the administrative branch of the Centennial Exhibition and now connected with the Permanent Exhibition, in a recent informal interview with Secretary Evarts, said, as they had the machinery for such work now in efficient organization, they would be happy to co-operate in any way that he might feel disposed to utilize their services. Another plan suggested by a number of prominent American manufacturers of machinery is that some person now in Paris connected with the State Department may be temporarily detailed to take charge of such shipments as may be made until Congress can meet and make the necessary appropriation.

Our Consul at Berlin has submitted to the Secretary of State a prospectus of the Leather Exposition, which is to be held in that city from the 8th to the 24th of September, and recommends that the American manufacturers of that necessary article send exhibits of their wares, which he thinks will turn out very beneficial to the leather trade.

From the Spanish Minister, Secretary Evarts has received a notification that an International Exhibition of Fine Arts will take place in Madrid in January of next year, under the auspices of his government.

Our Consul at Odessa, in a late report to the State Department, has the following: "Agricultural implements might be sent in great quantities to this country if our manufacturers would make an effort in that direction and adapt their implements for the use of the peasantry here. The principal thing to be done is to make them exceedingly firm and strong. American reapers and mowers are now the favorites above all others, and have a large sale. In other machinery the English manufacturers have the field, and I have seen no article of their manufacture that excels the American, unless expensiveness be deemed an excellence. I am persuaded that there is a fine field here for the American threshing machines. During the year an American firm has supplied a railroad here with fifty-five locomotive engines. They were remarkable in strength, power, and workmanship; and I am told that they draw a train easily through heavy snows that, with the engines formerly in use, would have been impassable."

Some three or four years ago, Congress appropriated \$100,000 to be expended in experimenting on steam boiler explosions, to discover if possible the cause of some of the mystery that is believed by many to be connected with these accidents, which mystery, however, is generally believed by the best informed engineers to consist in low water. During the then ensuing season, a Commission, of which the Supervising Inspector of Steam Vessels was the chairman, made a series of experiments at Sandy Hook, and about one half of

the appropriation was spent without results of any value worth mentioning. The next season the Secretary of the Treasury placed a gentleman of scientific attainments at the head of the Commission, but with no more satisfactory results. It has now been determined to change the location of the experiments to Pittsburgh, but only about \$8,000 of the appropriation remains unexpended, and it is feared that little or nothing will be gained by the expenditure of the \$100,000, although great expectations were formed by many of the amount of knowledge that would be obtained from the expenditure of so large a sum.

There are encouraging indications that the spawn of the Californian salmon, deposited at or near the head waters of the Atlantic coast rivers by the United States Fish Commission, has produced large numbers of the young fish. Reports state that young salmon nine inches in length have recently been caught at the mouth of the Connecticut river. They were probably making their way to the ocean, as the young fish are said to remain in fresh water some twelve or eighteen months before going seaward, returning in two or three years weighing from ten to fifteen pounds each. A Richmond paper reports that salmon of the same size as those found in the Connecticut were caught in Hampton Roads going to the ocean, and thinks they were, no doubt, some of the young ones deposited in the James river by the Fish Commission in the winter of 1875-6.

The Director of the Mint estimates that the coinage at San Francisco for the present fiscal year will reach \$45,000,000, including \$13,000,000 of silver coins.

From a statement furnished by Dr. Young, Chief of Bureau of Statistics, it appears that the aggregate imports and exports for April were: Total exports, \$44,515,439; total imports, \$42,062,696; for the past ten months of the current fiscal year the exports of merchandise were valued at \$514,799,053, the imports for the same time being only \$357,584,817, showing a balance in favor of over \$157,000,000.

Mr. H. C. Fisher, the general manager of the English postal telegraph, and Mr. W. H. Preece, the engineer, are here for the purpose of making an examination of the working of the American telegraph systems, particularly the use of the sound system, which has not yet been introduced in London, and will visit the principal cities and examine all the operations connected with transmitting and receiving messages.

The Postmaster-General is constantly in receipt of letters from parties who claim to have discovered an indelible ink for cancelling postage stamps. Impressed with the value of such an ink, which would effectually prevent the use of washed stamps, the department made arrangements with experts to test all inks presented, and public notice was given that any ink that was claimed to be indelible would be so tested, and, if the result proved satisfactory, the ink would be adopted. The result was that a large number of samples of ink were presented, and for nearly two years the department experts were engaged in testing these so-called indelible inks; but these tests proved the inks to be so far from indelible that they were discontinued by order of the Postmaster-General; and as there are now no longer any tests made, it is useless for inventors to forward any more samples.

Washington, D. C.

OCCASIONAL.

"Knowledge is Power."

Every year an oration is delivered before the Hunterian Society of London, in eulogy of John Hunter, the celebrated physician, from whom the society takes its name. The address of Dr. W. Moxon for the present year is remarkably vigorous. The following is an extract:

"The great fallacy of the age is the vulgar fallacy that knowledge is power. But not all knowledge is power. Only the knowledge you have faith and aim to use is power; and the instinct of each mind is, I believe, a far better judge of how much knowledge it has faith and aim to use than we commonly suppose. Knowledge is not power. Any fourth year's student knows much that Hunter did not, and could not, know. But where is the power of Hunter? Power arises by training in the use of knowledge. Consider the difference between training and teaching. The teacher carries over the things he knows, and fixes them in the learner's memory; the trainer takes what is in the memory, and converts it into an organ for the pupil's own use. The store of memory of things taught is totally distinct and separate from the trained mechanism for use of knowledge. And these two different things—the store and the mechanism—are in separate places in the brain. It is only of late years we can be sure of this. We have it proved obviously in the case of language in what is called aphasia. In aphasia, a person paralyzed on the right side of his body has lost the power of using language, and yet understands all you say. Obviously, then, the understanding of speech is in one place, and the power of framing language is in another place, in the brain. The same is true throughout all human acquirements. The power of knowing is the fruit of knowing, and the power of acting is the fruit of acting. There is knowledge stored in one place, and the power of using it stored in another place. Teaching is the storing of knowledge; it may be done quickly. Training is the creation of an organ for use of knowledge; it needs much time; it is a slow process. The trainer has to convert the pupil's knowledge into motive, his desire into patience, his will into skill. Every good trainer aims to raise up in the pupil's mind a self-training faculty, which shall itself continue to train more and more knowledge into motive. By such

training knowledge becomes power. But knowledge, as given by the mere teacher into the memory, is not power; it is so much weight, which by training may become the instrument of power. Now, the self-training spirit is natural to some men—to all great men. On the other hand, the self-training spirit is almost absent in some men. These are the fools, and they trouble every one as to what is to be done with them. But the vast majority of men have some self-training faculty; and the proper aim of education is to support this, which I may call the vital spark of character, by help from the training faculties of others."

Birds' Nests.

"The best way to find nests is to watch a bird while building; in that way, moreover, you are sure to see them in their best condition, and to know when the eggs are fresh. It requires patience; but you see the workers return again and again to the same spot, and a little closer inspection usually completes your knowledge, though you may sometimes be deceived or nonplussed by the caution and cunning of the architects. You will facilitate your work by scattering cotton wool, horsehairs, straws, string, worsted, and cloth where they will attract the attention of the birds about you. Put them on your lawn or on the piazza vines, and watch them. A robin comes to carry off the string, and, having used up what you have provided, and liking the material, attacks a long piece wound round a stake, and supporting a gladiolus. By persistent effort he frees a part of it; but the harder that he pulls the rest, the tighter he ties the knot around the stake, and the string is becoming entangled with his legs; he fights twenty minutes and then gives it up. Sparrows pick up hairs and straws from the lawn, and warblers come to the vines for cotton wool, passing fearlessly within three feet of your chair; then they come back to break off little twigs and to peel off shreds of dry bark from the honeysuckle. A pair of golden robins, the male with black and orange, the female with yellow and duller black, come for string, worsted, and thread; but beware of them, for they are thieves. Leave your knitting under the tree there for five minutes, and it is gone; you will find it a week later, a part irrevocably woven into the hanging nest, and a part dangling with the needle in it. The weaving is so cleverly done that you wonder whether the orioles haven't used your needles. Not at all, madam; I defy you to produce with your implements such a piece of work as these birds have produced with their bills. Successful experiments have been made by supplying the orioles, in the tree where they are occupied, with bright silks and worsteds, which they employ altogether, if liberally provided, so that a very gay and party-colored nest may swing in your orchard where you can see it from the house. Wilson says that an old lady, to whom he showed an oriole's nest in which a piece of dry grass, thirteen inches long, was passed through thirty-four times, asked him, half in earnest, if the birds couldn't be taught to darn stockings."—H. D. Minot, in *Harper's Monthly* for June.

Waste in Machine Shops.

A workshop, however small, however few the number of hands, is never too small to have a system; want of system is the cause of great waste of time and material, besides constant worry and discontent.

Step inside this building of fair dimensions, whose front is covered with big lettered signs, showing that it is devoted to the production of all kinds of machinery.

What do we find? The floor covered with litter, heaps of cuttings under every lathe or machine, under every bench; on the floor new and old material of all kinds have been thrown in almost inextricable confusion; the machinery is encrusted with oil and dirt, except just those parts that meet the hand in working; and the speed cones and pulleys are polished by the running belts, showing what might be and is not.

The cutting tools, the bolts and plates, and other gear used in these machines, lie around their bases; a new stratum seems to be fast closing over some of them. Overhead is heard the harsh grating of some loose pulley; the belts have been thrown off others by some sensitive workman, who cannot bear the unpleasant noise in such cases; the belts dangle from the shafts, the running shaft keeping a stretch on them and wearing them all the time. About thirty men are employed in these works, yet there is no one whose special duty it is to look after the tools, to replace or repair them when lost or broken.

A man has to drill a $\frac{1}{4}$ inch hole in a piece of plate; the time actually required would be about five or ten minutes if good order were kept in this case. The man commences by making a tour of the shop, for there are some drills lying around this machine, and some around that, and there is no one place where every drill not in use is sure to be found. His search is not crowned with immediate success; a $\frac{1}{4}$ clearing drill ($\frac{1}{4}$) is the nearest he can procure; he has set his callipers and taken the size of it; he proceeds to grind it to $\frac{1}{4}$; having reduced it to the size, he finds it will not clear itself so high as he wishes; however, at last, by more grinding, he is satisfied with it, and is ready to commence—time lost, twenty minutes. He is hardly through drilling, when up comes a man looking for the $\frac{1}{4}$ clearing drill he was using twenty-five minutes ago; he, finding it has been altered, takes it to the smith, and waits to have it flattened out, which, with the re-grinding, makes a further loss of twenty minutes—total loss, forty minutes on the drilling of a $\frac{1}{4}$ hole, for which the boss could scarcely charge more than ten cents.

Another has a brass to plane; no tool for brass seems to be visible; he has probably trodden it down too deep in the thick red dust of the flooring to be distinguishable. However, he soon grinds off the tip of a tool for cutting wrought iron; that is easy enough; but when that tool is wanted again to work in the material it was made for, a $\frac{1}{4}$ of an inch must be ground off its facets to restore the original angle—waste of time and steel.

If a workman should happen to drop a small pin, washer, or key, he makes another, because among the *débria* around he knows it is as much lost as though when it fell the earth had gaped to receive it.

Here is a man who has been half an hour filing out the hammer marks he has made in fitting two finished pieces together; another, the same time truing up an arbor damaged by blows on its center with a steel hammer. There was a copper hammer once, but it laid around and now no one knows where it is. A few of the old hands have lock-up boxes, chock full of all kinds of tools and contrivances, and are laughing in their sleeves at the frantic efforts others are making to produce a good job without those proper instruments, kept so securely under lock and key.

The grindstone—that much abused necessity of the workshop—is all out of true, has no water can, and sometimes not even a rest; it is nobody's special duty to keep the grindstone in order, and hence nobody does so, while everybody grumbles at its dilapidated condition. As to its speed, the pulley now driving it was put on when the stone was of large diameter, and there it has remained ever since, so that the velocity of the stone is about half what it should be; the slower the speed, the worse condition the stone can get into without wrenching the tool from the hands when grinding with the stone running towards you; hence the speed of the stone is admirably suited to its condition, and both are excellent levers to hoist the proprietor into bankruptcy, which under the above circumstances would just serve him right.—J. R., in the *Polytechnic Review*.

Employers and Working Men.

Difficulties between employers and working men would be less frequent, says the *American Manufacturer*, were their intercourse more conciliatory, and were each to realize that seeming inequalities are but surface appearances; and that the best interests of the one can only be secured in the protection and welfare of the other. Governed by such dispositions and opinions, irreconcilable differences could scarcely arise, because each would take a fair view of the rights and obligations of the other, and willingly make the concessions required by justice and kindness. A reasonable amount of information, derived from observation and reading, is a pre-requisite qualification, and is always found wanting, on one side or the other, where jars and contentions disturb the harmony essential to these relations. Admitting this qualification to be possessed by employers, a further duty devolves upon them, of insisting that their workmen shall possess it also. Men utterly illiterate, who can neither read nor write, cannot possess the self-respect and ambition needed to form skilled mechanics, neither can they be sufficiently enlightened to comprehend their rights and duties, to know when they are well treated, or to understand the fluctuations in business which justify the rise and fall of wages. It is therefore a duty of employers to employ none but persons sober, moral, diligent, and accustomed to reflect—men with whom they can sit down and reason—who can understand just conclusions, and feel the overruling propriety of abiding by them. Where large establishments are organized on these principles, the business moves on with contentment on both sides—each respects the rights of the other—misunderstandings are quietly settled without strikes, and peace and mutual goodwill reign as in well regulated families. Where the instrumentalities of labor are organized, with intelligence and integrity of employers, and with workmen suitably cultivated for respectable American citizenship, the most desirable consequences may be reasonably hoped for: 1. Superior safety of capital in enlightened hands. 2. Economy of time and labor when conscientiously employed. 3. Economy in the use of stock and materials manipulated by instructed men of good principles. 4. For the same reason, the best results may be looked for as to quality and quantity of products. 5. Interests of customers and consumers are better subserved with fabrics made upon honor. 6. Ignorance is the generator of crime and vice, producing the worst consequences where it prevails. 7. The safety of society can only be conserved by enlightened citizens, and are jeopardized by the malignancy growing out of general ignorance. 8. It is impossible to over-estimate the social value of making workmen good and useful citizens. 9. So to elevate a large class, gives stability to schools and institutions for moral and intellectual culture. 10. Working men constitute a large majority of our people, and whatever lifts them up in the social scale is important to the whole community. 11. In numerous eastern cities and towns, the benign efforts of cultivating the industrial class are visible in good order and the general moral tone of society. 12. It is, manifestly, a primary duty of employers, to themselves and to society, to give preference to workmen of intelligence and morality; where such qualities are uniformly preferred, those who possess them not will strive to attain them, and they will form an essential qualification in preparing youths for employment.

THE Providence Tool Company are making 600 guns a day for the Turkish Government.

THE NEW GRAIN ELEVATOR IN NEW YORK CITY.

As it is now manifest that the war in Europe is destined to render this country the principal source of grain supply to foreign markets, it also is apparent that increased facilities for handling grain will become needed at all points of shipment. Inventions, therefore, tending to improve upon present methods of loading and unloading cereals are, or

measures 154 feet in height to the peak of the roof. It is erected on made ground, some 7,000 piles having been driven into the river bed at intervals of 2 feet 9 inches between centers. These are cut off below low water level, filled in with sand, and transversely capped with heavy timbers. Two diagonal cappings follow above, and a series of granite piers, pyramidal in shape, finally support the ponderous timbers

is taken up much more rapidly than other kinds. The lower portion of the elevator legs—there are eleven in the building—is made of plate iron from the foot to the bottom of the bins; through the bins, 2 inch pine planking is used. Each elevator has a 22 inch six-ply gum belt, on which the buckets are attached at intervals of a foot.

As the grain reaches the bottom of the receiving pit, it is

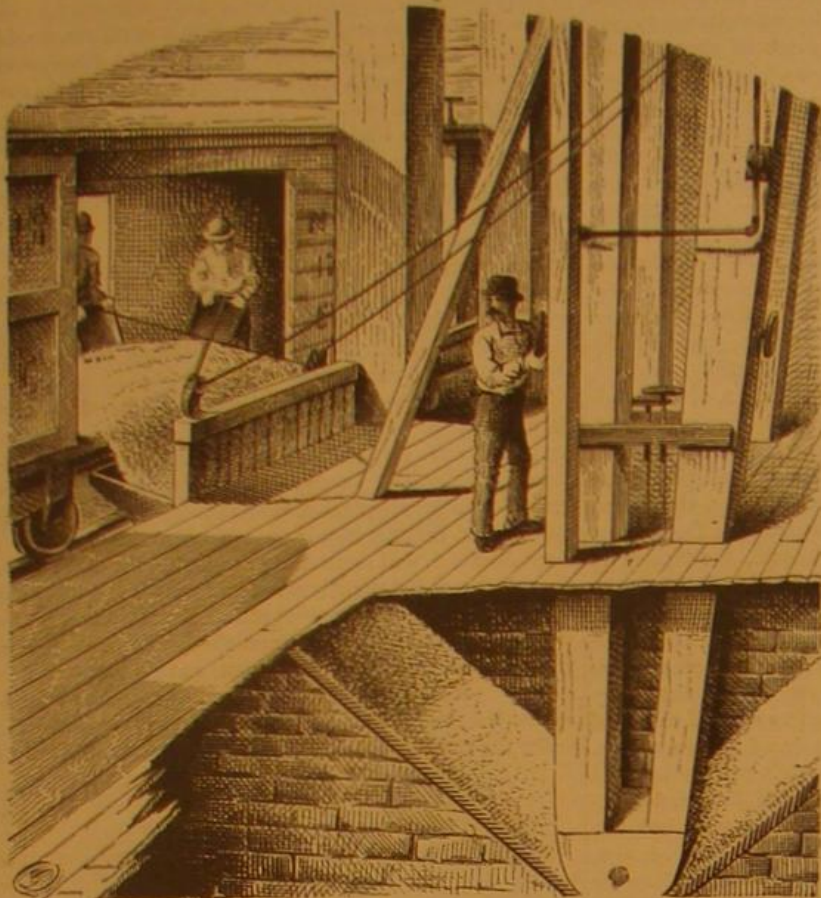


Fig. 1.—TAKING GRAIN FROM THE CARS.

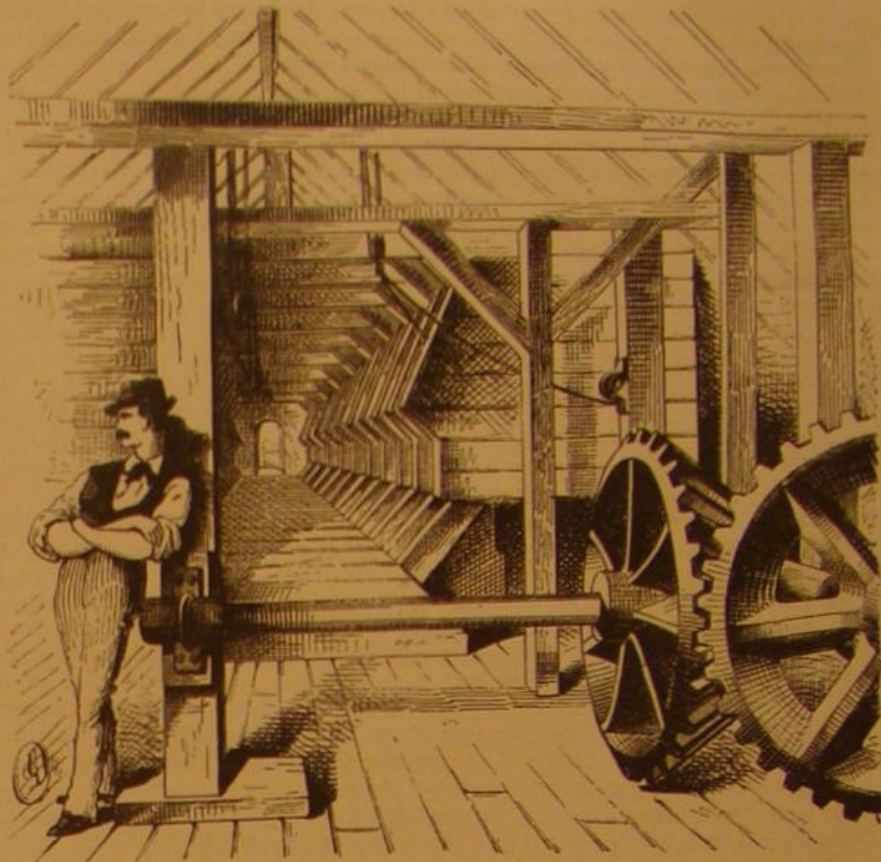


Fig. 2.—THE HOPPERS AT THE HEADS OF THE ELEVATORS.

soon will be, the subject of especial demand. As there is an excellent field for inventive work in the present form of grain elevator, we have prepared the annexed series of engravings from the fine building of this class, recently completed by the New York Central and Hudson River Railroad Company, at the foot of 60th Street and North River, this city, which conveys a good general idea of probably the most improved machinery, etc., now employed for grain transshipment and storage. There are other elevators in the country

which sustain the bins. Of the latter there are 7 rows, 33 in each row, making 231 in all; and there are shipping bins in addition. There are 182 large bins, measuring 9 feet by 13 feet 3 inches by 72 feet deep; others are variously subdivided to make smaller receptacles. The walls of the bins are of 2 inch planks laid flat, and strongly spiked together, the width of the boards making the wall thickness. The total capacity of the bins is 1,500,000 bushels.

We shall now trace the progress of the grain from the time

scooped up by the buckets and carried to the uppermost garret of the building. Here we have followed it in Fig. 2, which represents the long perspective of lofty elevator heads. The elevator belt here passes over a 6 foot pulley, the journal of which has a hinged bearing, so that the pulley may be raised and lowered by means of a lever and cord. In this way it is brought into or out of contact with a friction pulley on the main driving shaft. A part of the heavy bevel gearing by which power is transmitted from shaft to shaft is shown in the foreground of the engraving. The friction pulley referred to is made of brown paper pressed in between iron disks, 2 feet in diameter; its face also measures 2 feet.

The grain in the buckets is carried over the large pulley and is at once discharged into a weighing hopper, Fig. 3, on a floor below. This hopper stands on an 18 ton scale; and as fast as the grain within it is weighed, a valve is opened by which the grain escapes through the swinging spout on the next floor below, shown in Fig. 4. This spout may be turned by hand, so as to eject the material into any one of the open conduits, the mouths of which are placed around the cir-

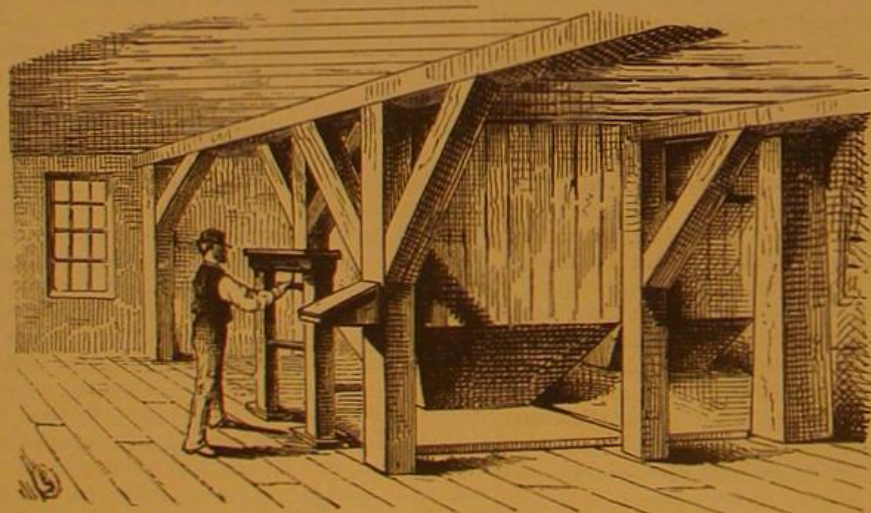


Fig. 3.—THE WEIGHING HOPPER.

much larger than the one here referred to; but the latter, constructed under the engineering direction of Mr. Charles Hilton, is practically a combination of the best results of experience as exhibited in the principal older structures in Boston, Chicago, Baltimore, and elsewhere.

The building is of wood, with an exterior envelope of brick. It is 354 feet in length by 100 feet in width, and

it enters the building on the cars until the final delivery into the vessels. Four tracks enter the building at the north end; and between the outside pairs twenty-two receiving pits are arranged, the disposition of one of which is shown in Fig. 1. Each receptacle is a huge wrought iron tank, sunk in masonry and lined with boards. Each has two hatches with hoppers, abreast of which the doors of the freight cars are brought. The grain is then removed from the cars by steam shovels operated by simple overhead mechanism. By this means the unloading is very rapidly accomplished; and the grain slides down the inclined side of the pit until it meets the lofting elevator leg, the foot of which descends to the lowest point of the pit. Here is a valve adjusted by a wheel above (shown in the hands of the workman), which checks the supply of grain to the buckets in accordance with the nature of the material, as some grain

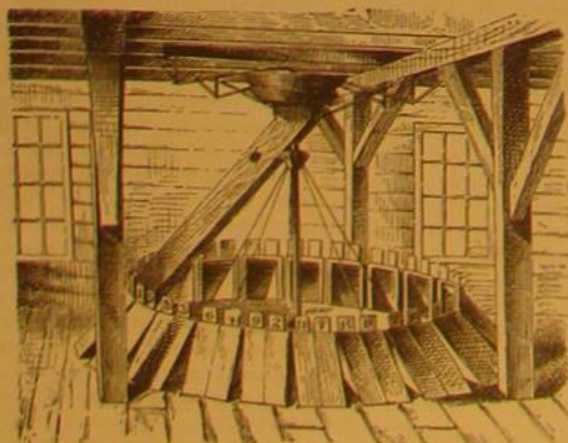


Fig. 4.—THE SWINGING SPOUT.



Fig. 5.—LOADING THE VESSELS.

cumference described by its lower extremity. As all the bins are numbered, and as each conduit bears a similar number to the bin to which it leads, it is merely necessary to adjust the spout to any desired opening to divert the grain to the proper bin. A blackboard, painted on a partition, is divided into numbered squares corresponding again with the bin numbers; and in each square a record is kept of the contents of the bin, so that the person in charge can see at a glance just where the incoming grain may be stored.

The grain, now being in the bins, is there left until it becomes necessary to load it aboard vessels or otherwise prepare it for transportation. If the vessels are to take it in bulk, the grain is allowed to escape from the bins through spouts

Blowpipe Apparatus.

A prize of \$50, which has been placed at the disposition of the Council by Colonel A. A. Croll, is offered by the Society of Arts, with the Society's silver medal, for the best set of blowpipe apparatus which shall be sold retail for \$5. The apparatus must, at least, contain blowpipe, blowpipe lamp or candle, spirit lamp, charcoal or charcoal pastilles and holder, platinum wire, glass tubes closed at one end (matresses), open glass tubes, platinum-tipped forceps, magnet, hammer and anvil, and four reagents, namely, borax, microcosmic salt, carbonate of soda, and nitrate of cobalt. These instruments and reagents, together with any other which may be thought desirable, must be packed in a box. It must be

Milk and Butter.

There are no farmer's productions, says the *Maryland Farmer*, so subject to injuries from many slight causes as milk and butter, and none so sensitive to unpleasant odors of every kind; none that is so much and as readily deteriorated in value as these are. Hence, all kinds of uncleanness should be avoided, and the utmost neatness should be observed in every step of their production and marketing, from the very feeding, handling, and milking of the cows, as well as treatment and handling of the milk, with the churning, working, and putting up of the butter. All of the implements used, the water and salt used, and the rooms occupied in keeping the milk and making the butter, should be kept



Fig. 6.—THE BAGGING FLOOR.

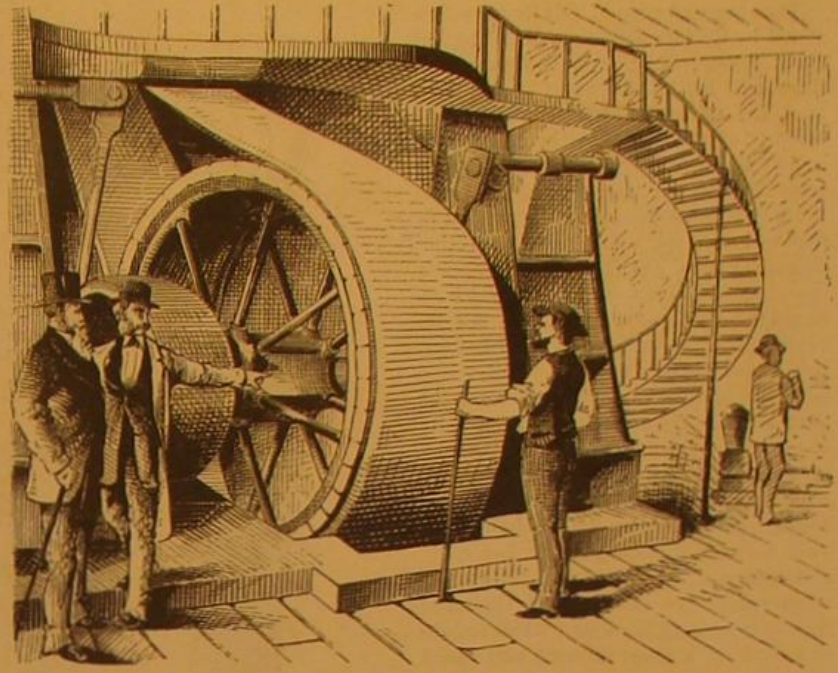


Fig. 7.—THE STEAM ENGINE.

back into the receiving pits. Hence it is re-elevated to the top of the building, and passes first into a weighing hopper and then into a shipping hopper immediately below. By thus using two hoppers, the delivery of the grain is rendered continuous, as, while the weighing hopper is being filled, the shipping hopper may be emptying into the spout which leads down outside the building and thence directly into the vessels, as shown in Fig. 5. If, however, the grain is to be bagged, then, instead of going down into the receiving pits, it is drawn off by a simple valve to the bottoms of the bins directly into the sacks. The floor directly beneath the bins is thus known as the bagging floor, Fig. 6. As soon as a workman fills a bag, he closes the valve and places another bag in position. Another operative ties the first bag, and places it on the conveyer, which is a large rubber belt running in an opening and level with the floor. This transports the filled sack to the side of the building, and throws it off upon an inclined trough, down which it slides and emerges through an opening in the wall upon a wagon placed to receive it.

Figs. 7 and 8 represent the engines and the immense main driving belt. The engines are two direct-acting, vertical, inverted, with cylinders 34 by 34 inches. The average pressure is about 60 lbs. of steam. The belt, Fig. 8, is the largest in the country, measuring 4 feet in width and 331 feet in length, and weighing 2 tons.

Electricity in the Production of Galvanic Deposits and of Chemical Decomposition.

All who are acquainted with electro-magnetic machines know that the maximum of effect produced corresponds with the moment when the current is best closed, and the minimum with that when it is most open. The author was led to think that electrolysis might derive advantage from this principle. Hitherto, when desirous of effecting a metallic deposition or a chemical decomposition, a single bath has been used, into which were plunged two anodes more or less closely approximating. That is to say, we have placed ourselves in conditions approaching those of the least electric resistance and the maximum of effort. The author has therefore multiplied the baths, taking care to connect their anodes, as is done with the elements of a battery arranged for tension. The result was that the totality of metal deposited increased with the number of baths.—*M. Arn. Thenard.*

Adulteration of Bread and Flour with Gypsum, Heavy Spar, Etc.

A Rotterdam firm has been recently offering finely ground gypsum to various millers in the province of Hanover. To detect such frauds Vohl mixes 10 grains of the flour with 20 grains of potash saltpetre, places the mixture in a platinum vessel, and ignites with a red-hot platinum wire. If the flour is pure the pale green melted mass dissolves almost entirely in water, and the solution, scarcely turbid, gives no precipitate with hydrochloric acid, which, if it appears, indicates the presence of silicates. The acidulated solution should give with barium chloride merely a slight turbidity. A decided precipitate indicates the presence of sulphate of lime or of baryta.

understood that the above list of apparatus, etc., is only intended to include such as are absolutely indispensable, and it is expected that the set will contain additional instruments and reagents, the selection of which is left to the competitors. Special attention should be paid to the following points: 1. Solidity of construction. 2. Compactness and portability. 3. Facilities for packing and unpacking. 4. Number of useful instruments and reagents in addition to those mentioned. The Society does not engage to give the

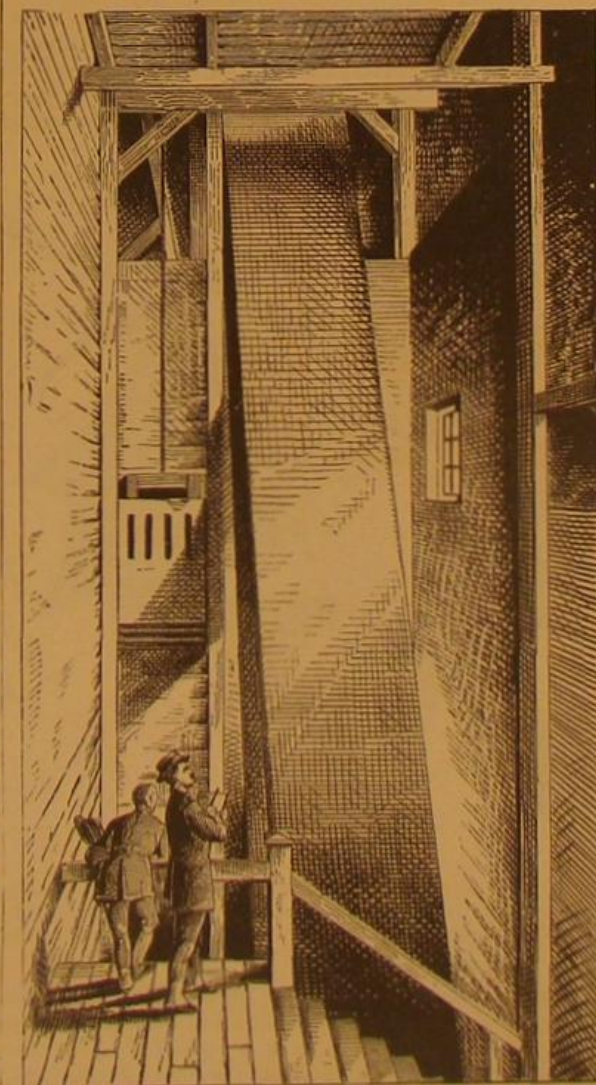


Fig. 8.—THE DRIVING BELT.

prize unless some apparatus appears to show sufficient merit, and some advance in merit on what is now obtainable for \$5. All apparatus for competition must be sent to the Society's House, London, on or before the 1st of August, 1877. The successful competitor must guarantee that a proper supply of the apparatus shall always be kept on hand, for sale in England.

perfectly clean and sweet, in order to produce the best quality to secure high and fancy prices. No article that the farmer produces for the market has such a wide range of difference in price as butter, not even cheese or choice fruit. We see by quotations in all the great butter markets that the prices of eating butter range all the way from \$1 to 10 cents per lb., while greasy, cooking butter is even lower than that; even the packages in which it is put up, whether firkins, pails, tubs, or rolls, affect the prices for which it sells. Grains and meats have but a small range compared to butter; the difference in the prices of butter is much greater than the difference in the cost; hence, it is much more profitable to make and sell a first-class article than a poor one.

Greasing Axles.

On the authority of the *Carriage Monthly*, more injury is done to carriages and wagons by greasing too much than the reverse. Tallow is the best lubricant for wood axles, and castor oil for iron. Lard and common grease are apt to penetrate the hub, and work their way out around the tenons of the spokes and spoil the wheel. For common wood axles, just enough grease should be applied to the spindle to give it a light coating. To oil an iron axle, first wipe clean with a cloth wet with turpentine, and then apply a few drops of castor oil near the shoulder and end. One teaspoonful is enough for the four wheels. Carriages are sometimes oiled so much that their appearance is spoiled by having the grease spattered upon their varnished surfaces. When they are washed in that condition, the grease is sure to be transferred to the chamois from the wheel, and from thence on to the panels.

The Cockroach Utilized.

In Russia the common cockroach (*blatta orientalis*) is a favorite popular remedy for dropsy. Dr. P. Bogomolow, of St. Petersburg, has lately examined its effects in nine cases of Bright's disease, heart disease, and other affections accompanied with severe dropsy, and in all the result was the same. There was an increase in the secretion of the urine and perspiration, with rapid disappearance of oedema, and also almost complete disappearance from the urine of albumen and renal derivatives. The dose was five to ten grains of the powdered cockroaches in the twenty-four hours, but they were also administered as a tincture and as an infusion. These insects do not, like cantharides, says the *Boston Journal of Chemistry*, produce any irritant action on the kidneys. Dr. Bogomolow has succeeded in extracting from them a crystalline body which he calls antihydropsin, and which is their active principle.

Detection of Oleomargarin in Butter.

Professor G. Lechartier says that fresh genuine butter which has not been melted appears under the microscope composed of ovoid granules, and contains no crystals. The artificial product obtained from tallow 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.

THE HELLGRAMMITE.

BY PROFESSOR C. V. RILEY.

Few insects excite more curiosity than the gigantic fly (*Corydalus cornutus*, Linn.), to which I desire to introduce the readers of the SCIENTIFIC AMERICAN. It is our largest neuropteran, or nerve-winged insect, belonging to the family *siabidae*. Of not unfrequent occurrence over the Atlantic, Middle, and Western States, it is most often met with along water courses, and is vulgarly called the "hellgrammite" in the Mississippi Valley; and this cognomen, the origin of which is somewhat obscure, has been generally adopted by entomologists. There is a certain formidable look about the creature; and though it is absolutely harmless, a great many people have a superstitious dread of it.

The supposed eggs of this fly were first found by the late Benjamin D. Walsh, of Rock Island, Ill., and were figured and described in the *American Entomologist* (Vol. I.), and in the fifth "Entomological Report" of the writer, as "oval, about the size of a radish seed, of a pale color with some dark marks," and "deposited in the summer months in closely set patches of fifty and upward, upon reeds and other aquatic plants growing along running streams." How it was that Mr. Walsh referred these eggs so confidently, and without qualification, to this particular species, it is impossible now to say. Walsh was a most careful observer and writer, and the accuracy of his conclusions in this instance was never questioned either by myself or others. Yet the eggs of our hellgrammite are, in reality, totally different. In passing up the Mississippi last July, between Bushberg and St. Louis, my attention was attracted to a number of white splashes on the leaves of vines and trees overhanging the water, which splashes looked at a short distance very much like the excrement of some large bird. But upon closer inspection each splash had a more or less regular, circular or oval bulging about the middle; and upon procuring some of the leaves thus laden, a glance sufficed to show that each swelling was in reality an egg mass. Within the distance of a mile I obtained over thirty of these egg masses, there usually being one to a leaf, and that on the upper side, but sometimes three or four, and in one instance eight—five on the upper and three on the lower surface. They were found alike on cottonwood, sycamore, elm, and grape vine, but in every instance on leaves overhanging the water, thus indicating that they belonged to some aquatic animal, and that the leaf was but a temporary place of attachment. The mass is either broadly oval or circular in circumference, flat on the attached side, and plano-convex on the exposed side. It averages 21 millimeters ($\frac{4}{5}$ inch) in length, and is covered with a white or cream-colored albuminous secretion, which is generally splashed around it on the leaf or other object of attachment.

Each mass contains from two to three thousand eggs, the outer layer forming a compact arch, the eggs placed side by side with the anterior ends inside, and the hind ends showing like so many faint dots through the white covering. Those of the peripheral row lie flat upon the object of attachment, and the others gradually diverge at their outer or hind ends, so that those in the center of the arch are at right angles to said object. Beneath this vaulted layer the others are packed on a plane with the object, those in contact with it arranged in concentric rows, the rest packed in irregularly. Each egg is $\frac{1}{16}$ inch long, about one third as wide, ellipsoidal, translucent, sordid white in color, and with a very delicate shell; and each is surrounded and separated from its neighbors by a thin lining of the same white albuminous substance which covers the whole. Before hatching, the color of the eggs deepens into fuliginous, and contrasts more strongly with the intervening white. Now the nature of these eggs not only puzzled myself but every prominent entomologist in the country to whom I referred them. The eggs of all the larger water beetles are known and described, and those of our hellgrammite were also supposed to be. There is a large water bug (*Belostomatidae*), but these eggs were evidently not heteropterous. No dipterous insect was large enough to produce them, and the *hymenoptera*, *lepidoptera*, and *orthop-*

tera were out of the question. In fact, Walsh's blunder threw me off the track, and I had to patiently await development. Presently, to my great joy, the young began to hatch; and being perfectly familiar with the full grown larva of *Corydalus* in all its details, I at once recognized this species in my young curiosities. For the first time it struck me that Walsh had made a mistake. An examination of the contents of the abdomen of a gravid hellgrammite in my cabinet at once settled the question, and made it manifest that the eggs that had just hatched belonged, without any question, to this gigantic fly.

As to the nature of the eggs that have hitherto been mistaken for them, and which are represented in Fig. 3, we can only surmise. The specimen from which the engraving was

the species live three years in this larval condition. Most aquatic larvæ transform to the pupa state within the water, but this larva quits the water when full fed, as do the others of the same family, and crawls about for days seeking a place wherein to transform. We find, therefore, that Nature has abundantly fitted it for living in both elements, by giving it, first, two rows of nine breathing holes or spiracles, placed in the usual way along the sides of the body, which enable it to breathe out of the water;* and, secondly, two sets of nine gills or branchiæ, in the shape of lateral slightly hairy filaments which enable it to breathe in the water.



Fig. 3.—Supposed eggs of corydalus.

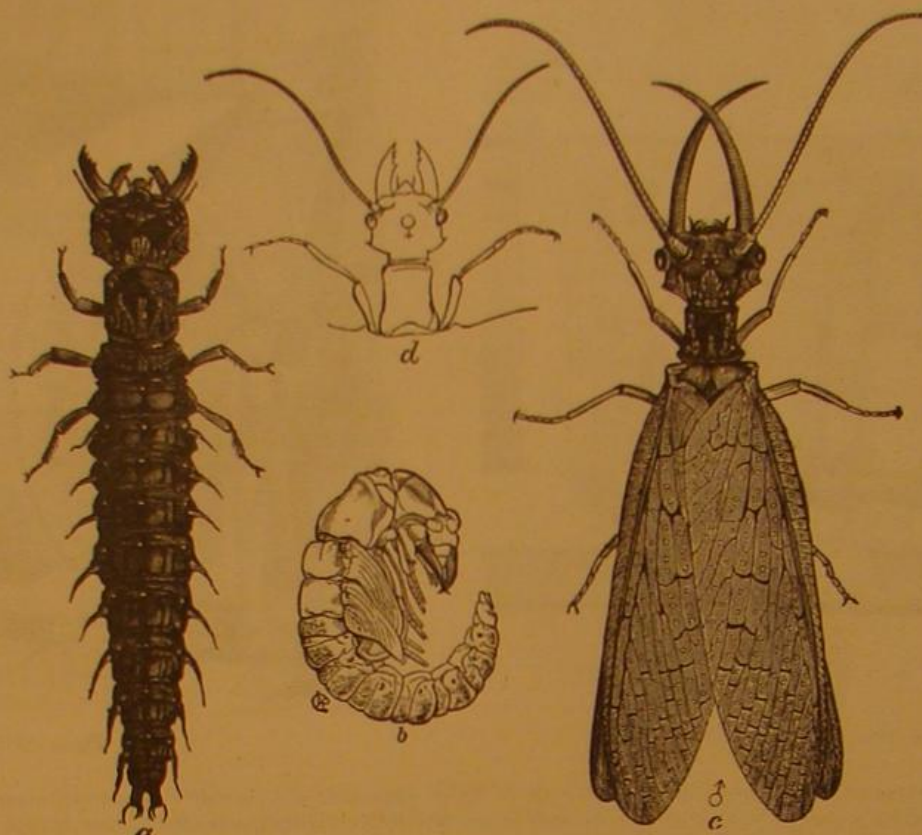


Fig. 1.—HELLGRAMMITE:—a, full grown larva; b, pupa; c, male fly; d, head of female fly.

made was destroyed with the Walsh cabinet in the Chicago fire; but I have a clear recollection of them, and am of the opinion that they belong to the large water bug (*Belostoma grandis*), the eggs of which are still undescribed.

The full grown larva of our hellgrammite is well known to fishermen, who, in this part of the country, call it a "crawler," and esteem it as bait. It measures from three and a half to four inches in length, is of a dark brown color variegated with light brown, the abdominal joints being tough and leathery, and the head and thoracic joints horny and

with tails hoisted in the air, over whatever surface they may fall upon. It is doubtless their habit to drop at once to the water and sink to the bottom, where they can anchor by means of the anal hooks, or find lodgment under some stone or rock. In an aquarium, in which I endeavored to rear and study them, they would float readily, with the body curved in the water and the head bent so as to rest at the surface. They also swam readily by sudden jerks of the body, especially by striking the abdomen beneath, very much resembling the actions of the common mosquito wriggler in

descending, but ascending head foremost, more like the pupa of that species. They did not seem to need to rise for air, and would congregate most at the bottom of the aquarium, and under such stones as were placed therein.

They none of them could be made to survive more than three days in such standing water, and the necessity of fresh running water to their well-being will always render difficult the study of the insect in its infancy.

After leaving the water, about the beginning of June, this larva travels, in the nighttime, sometimes to comparatively great distances, having been found nearly a hundred feet from its former habitat.

Mr. Walsh mentions a most curious incident in connection with its larval wandering, which I quote in full:

"A most respectable man, who keeps the toll bridge over Rock River, where this insect is very abundant, informed me that on several occasions its larvæ had fallen down one of his chimneys. His idea was that they must have bred there, but that, of course, is out of the question. The statement was confirmed by his wife, and I have no doubt of its truth. In 1863, I threw a larva of this insect into the Mississippi to examine into its customary mode of progressing in the water, which, as I found, was by crawling along the bottom, not by swimming. As it emerged from the water, it climbed with ease up the stump of a large white elm, which was stripped of its bark, and as smooth as any carpenter could have planed it. The stump was three feet high and upright, and when

* Mr. Comstock has found an additional pair of rudimentary spiracles on the hind part of a prominent fold between the meso and metathoracic joints.

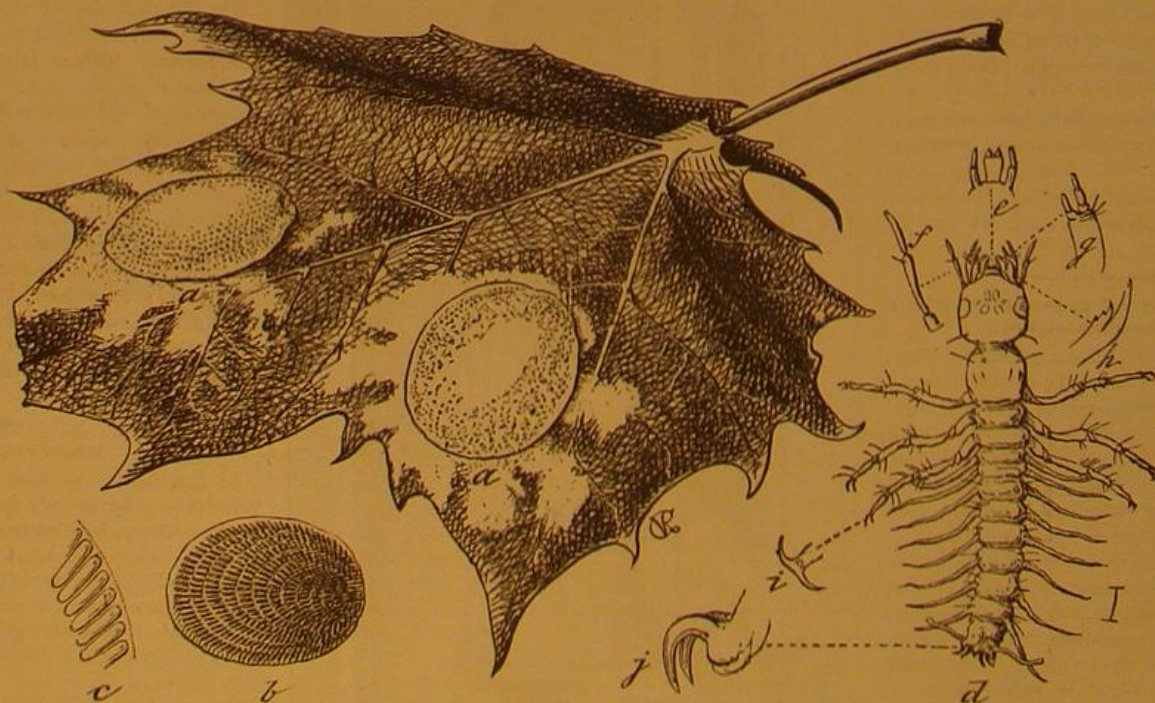


Fig. 2.—HELLGRAMMITE:—a, egg masses attached; b, same from beneath, just before hatching—natural size; c, a few outside eggs enlarged; d, newly hatched larva; e, labium; f, antenna; g, maxillæ; h, mandible; i, tarsal claw; j, anal hooks—all greatly enlarged.

polished. Though this larva can live for some time out of water, even when young, yet until it attains its growth it is strictly aquatic, abounding most in rapid-flowing streams, and especially such as have a rocky bottom, upon which it crawls slowly about, feeding upon other aquatic insects. Mr. J. H. Comstock, of Cornell University, who has been making some interesting anatomical studies on this insect, generally finds it in the most rapid portions of the streams about Ithaca, where it dwells mostly under stones. He has captured numbers by turning over large stones, and allowing the current to wash the larvæ into a dip net; and he is of the opinion, which my own observations support, that

It had reached the top it commenced descending on the opposite side; but, after a while, lost its foothold and fell into the water again. The pair of two-clawed appendages at the tail are used with much effect to assist it in climbing. The building which it must have climbed to reach the chimney, down which it is stated to have fallen, was only a low, one-story wooden one.

This larva can pinch with its formidable-looking jaws, but not forcibly enough to draw blood. In preparing for the pupa state, it burrows into the earth, where it forms an oval cell; or it hides under some large stone, piece of wood, or other substance. Here, in about two weeks, it casts its tough larval integument and assumes the pupa form, lying in a curved position in its cell, with the head, wing-pads, and legs deflexed on the breast. The color is yellow, with traces of the brown mottlings of the larva and of the lateral filaments. The spiracles are more conspicuous, and the upper jaws stronger than in the larva, and olive green. The pupa state lasts but a few days, and the perfect insect issues during the month of July. It is nocturnal in habit, and hides, for the most part, in obscure places during the day. It is sluggish at this time, and, if approached, will drop sooner than fly, or raise its head and abdomen and open its jaws menacingly.

The sexes differ greatly in this perfect state. The male is remarkable for having his upper jaws—which in the female are normal and fitted for biting—prolonged into incurved, prehensile appendages of the form of a grain cradle finger, and smooth and cylindrical, except at the tips, which are pointed, and minutely notched. As I have shown in my 5th report, there is no perceptible sexual difference in larva or pupa, unless it is, as stated by Haldeman, in the rather larger size of the jaws of the male. This feature cannot, however, be relied on. This similarity of the sexes, especially in the pupa, is the more remarkable that in the imago state they differ so greatly. The subsequent modification of the male jaws is assumed at the last molt; and if the jaws of a male pupa be dissected, the future finger-like jaws will be found crowded within them, like the "wrinkled finger of a glove pushed into a thimble," as Mr. Comstock expresses it. This modification in the male is evidently to enable him to embrace the soft body of the female, as it cannot well have any other use. The body of the hellgrammite is soft, and were the jaws of the male horny, and armed with teeth, in securing the female they would injure her, and thus defeat rather than aid procreation. In the large stag beetle or "buck-bug" (*Iucanus elaphus*, Linn.), on the contrary, where both sexes have very hard, horny bodies, the upper jaws in the male are greatly prolonged, but very stout, and armed with sharp prongs, the better to enable him to seize the female.

In these two cases we see how wonderfully the homologous organs have been modified in opposite directions to accomplish the same end. We find in Nature innumerable such curious contrivances and modifications, which at once excite our wonder and admiration. To quote Mr. Walsh's own eloquent words: "In so elaborate and diversified a manner does Nature adapt her plans and patterns to the ever-varying conditions of animated existence; and with such consummate care has she provided that the great fundamental law shall everywhere be carried out: 'Increase and multiply and replenish the earth.'"

It is worthy of remark that in both these large insects, in which the male upper jaws are so modified, this sex is far more common than the other. It is probably owing to the fact that the female seldom wanders away from her breeding place, and is, therefore, less often seen than her more restless and adventurous mate.

The Allen Governor.

The Allen governor, an extended illustrated description of which we published some time ago, is meeting, we are gratified to learn, with the substantial success to which, through its many merits, it is justly entitled. Over 2,000 of these governors are now in operation in this country and abroad, and the demand is constantly increasing. The manufacturers exhibit a series of testimonials, from those who have the machine in use, on all sorts of engines and under a great variety of conditions; and there seems to be but one opinion as to its great sensitiveness and general efficacy. We see from an advertisement in another column that agents are desired for the sale of the governor.

On the Estimation of Alum in Bread.

"For a long time past the old Normandy or soda process for the estimation of alum in bread, has been condemned on account of the great difficulty experienced in re-dissolving the aluminic hydrate or phosphate, after its precipitation, together with tri-calcic phosphate, etc. This has led to the production of several processes, most of which are very complicated. By a slight modification in the usual method of procedure, the Normandy method can be rendered as accurate in its results as any of those which have replaced it. This consists in adding the boiling acid solution of the charred bread to a boiling solution of sodic hydrate, containing a large excess. I proceed as follows: 1,000 grains of bread are burnt down to a small bulk, powdered with about 100 grain measures of hydric chloride, and warmed for a few minutes; about two ounces of water are then added, boiled for five minutes, filtered, etc. A solution containing about 250 grains of pure sodic hydrate is made in a very little water; and to this solution, when boiling, is very cautiously added the boiling acid solution of the charred bread, the whole boiled for a few minutes, filtered, and washed. The

filtrate, after the addition of a few drops of a concentrated solution of disodic phosphate, is slightly acidified with hydric chloride, and subsequently rendered just alkaline with ammoniac hydrate and boiled. The precipitate is collected, washed, and weighed as aluminic phosphate.

"To test the accuracy of this method, I had four loaves of bread made in my kitchen, one with no alum, the others with varying quantities. Care was taken to leave as little as possible of the dough adhering to the sides of the vessel in which it was made, so that each loaf contained, practically, all the alum that was dissolved in the water with which it was made. The loaves were weighed when one day old, and 1,000 grains taken of each:

Weight of loaf.	Grains of alum put in.	Weight of Al. PO ₄ from 1,000 grains.	= grains of alum in loaf.
1.. 2 lbs.	0	0.07 grains.	3.50
2.. 1½ lbs.	10	0.32 grains.	12.39
3.. 2 lbs.	20	0.46 grains.	23.80
4.. 2½ lbs.	40	0.76 grains.	44.20

"It will be seen that the method leaves nothing to be desired in point of accuracy, and will favorably compare with any other in respect to simplicity.

"Since devising the above process, I have been informed by Mr. Heisch that he, and he thinks others, have for many years applied the same principle (namely, the addition of the acid solution to an excess of boiling alkali) to the separation of aluminic hydrate from other gelatinous precipitates, having found it impossible completely to re-dissolve the aluminic hydrate by any amount of sodic hydrate if it were once precipitated."—W. C. Young, F.C.S., in *The Analyst*.

Mount Carmel, Ill., Destroyed by a Tornado.

The town of Mount Carmel, Ill., was visited on the 4th instant by a terrible tornado, which laid nearly the entire place in ruins. About 20 business houses and 100 residences were either destroyed or badly damaged by the fury of the gale, and by the fires which broke out at various points. The storm came from the southwest, and, from its track, seems to have been a cyclone traveling at an estimated velocity of 150 miles per hour. During its prevalence, the air was filled with flying roofs, lumber, clothing, etc., some of the debris being carried miles away. Thirteen persons are reported as killed, many others injured, and some seventy families were rendered homeless. The loss of property is said to amount to nearly \$500,000. No warning whatever was afforded of the approach of the storm. It seems to have struck the town and to have passed over it within two minutes, preceding a heavy rainfall.

Mount Carmel has about 3,000 residents, and her industries were largely mechanical. The SCIENTIFIC AMERICAN has many subscribers among those who have been afflicted, for all of whom we have the heartiest sympathy.

The Meeting of the American Association for the Advancement of Science.

The twenty-sixth meeting of the American Association for the Advancement of Science is to be held at Nashville, Tenn., on August 29. Sessions will take place in the Capitol. Special arrangements are being made for decreased railroad fares, etc., and for the accommodation of members in the city. The permanent subsections of chemistry, microscopy, and anthropology are to be continued, and the co-operation of students of these sciences is requested. The Entomological Club will meet on the day preceding the meeting of the Association.

Inventions Patented in England by Americans.

From May 15 to May 24, 1877, inclusive.
BATH OVERFLOW, ETC.—Valve and Faucet Company, New York city.
BOOK.—J. Clemens, Hartford, Conn.
BOOT-NAILING MACHINE.—L. R. Blake, Boston, Mass.
BOTTLE STOPPER.—N. Thompson (of Brooklyn, N. Y.), London, England.
CAR COUPLING.—E. Miller, New York city.
ELASTIC BAND.—F. Armstrong, Bridgeport, Conn.
LAMP.—J. H. Lewars, Philadelphia, Pa.
LAMP.—N. L. Rigby et al., Winfield, Kan.
METAL CARTRIDGE SHELLS.—J. H. Bullard, Springfield, Mass.
MOTOR FOR ROCK DRILLS, ETC.—E. S. Winchester et al., Boston, Mass.
ORNAMENTING GLASS, ETC.—S. M. Adams, New York city.
PAPER BOX, ETC.—E. B. Beecher, Westville, Conn.
PARING FRUIT, ETC.—W. H. Goodchild et al., New York city.
PORTABLE BOAT.—C. A. Fenner, Mystic River, Conn.
POSTAGE STAMP, ETC.—A. B. Foster, Providence, R. I.
POSTAGE STAMP, ETC.—J. Sangster et al., Buffalo, N. Y.
REFINING STEEL, ETC.—J. E. Sherman, Boston, Mass.
SCISSORS.—C. M. Moserole, New York city.
SCREW MACHINERY.—E. Nugent, Brooklyn, N. Y.
SCREW-THREADING MACHINERY.—S. S. Townsend, Philadelphia, Pa.
SCREW WRENCH, ETC.—B. L. Walker, Sing Sing, N. Y.
SEWER GAS TRAP.—B. P. Bower et al., Cleveland, Ohio.
SEWING MACHINE.—L. Dryfoos, New York city.
SPLINT.—D. Ahl, Newville, Pa.
TORPEDO APPARATUS.—H. S. Ross (of Chicago, Ill.), London, England.
TOY HORSE.—J. H. Nolan, Boston, Mass.
TREATING SLUDGE OIL.—W. P. Jenney, Brooklyn, N. Y.

DECISIONS OF THE COURTS.

Supreme Court of the United States.

PATENT STONE-CRUSHING MACHINE.—JOHN ROBERTSON, CHARLES C. MARTIN, and AUSTIN H. SMITH, APPELLANTS, vs. ELI W. BLAKE, ELI W. BLAKE, APPELLANT, vs. JOHN ROBERTSON, CHARLES C. MARTIN, and AUSTIN H. SMITH.

[Appeals from the Circuit Court of the United States for the Eastern District of New York.—Decided October term, 1876.]

The patent granted to Eli W. Blake for a stone breaker, June 15, 1858, released January 9, 1866, and extended June 15, 1872, is not anticipated by the earlier patent to Hobbs and Brown for "improvements in the application of well known mechanical means for the purpose of crushing ice," and to Hamilton for "crushing and grinding quartz or other substances," they not containing any of the essential elements of Blake's invention.

The substitution of one part of the operating mechanism, of a combination the equivalent of that omitted, does not avoid an infringement. When an original machine and an improvement upon it are both patented, neither patentee can use what does not belong to him without the requisite authority from the owner.

The complainant was found entitled to nominal damages only, the burden of proof being upon him; and it appearing that the proof was meager

and indefinite, but four machines made, no established license fee, the profits made being due in part to inventions covered by other patents, and no distinction made between profits accruing from the use of complainant's invention, and that from the other inventions and manufacturers' profits.

Mr. Justice Swayne delivered the opinion of the court:

These are cross-appeals in the same cause. Both involve questions in mechanics. These being determined, the legal propositions which apply are so well settled as to admit of no controversy.

A patent was granted to Blake on the 15th of June, 1858, by the United States, for a stone breaker. On the 9th of January, 1866, the same authority released the patent to him, with amended specifications. It was extended on the 15th of June, 1872. The bill in this case is founded upon the latter patent. It charges infringement.

The answer avers that the machine described is of no practical utility, denies the novelty of the invention, and also the alleged infringement. The description in the specification sets forth three things as the essential characteristics of the machine:

(1.) Two jaws within which the stones are to be broken. Their faces are to be so nearly in an upright position that the stones will descend between them automatically. The jaws are to be so far convergent that the interspace at the top will be sufficient to receive the stones, and that at the bottom only such as will allow the fragments to escape when broken of the required size.

(2.) A revolving shaft driven by steam or other motive power, imparting to one of the jaws a continual vibratory movement, causing it alternately to approach toward and recede from the other jaw, through a short and definitely limited space, so that when a stone is put in the movable jaw will advance and crush it, then receding liberate the fragments, which again descend, and, if too large, are rearranged and crushed again, and so on until the fragments have passed out through the open space at the bottom. The distance between the jaws is to be adjustable at pleasure, so that the stone can be broken of any desired size.

(3.) A flywheel is combined with the revolving shaft and movable jaw for the purpose of rendering the strain upon the power more equal.

The claim is for—

A combination of a stone-breaking machine of upright converging jaws with a revolving shaft and mechanism imparting a definite reciprocating movement to one of the jaws from the revolving shaft, the whole being and operating as set forth.

The combination in a stone-breaking machine of the upright movable jaw with the revolving shaft and flywheel, the whole being and operating as set forth.

In combination with the upright converging jaws and revolving shaft, imparting definite limited vibration to the movable jaw, so arranging the jaws that they can be set at different distances from each other at the bottom, thus producing fragments of every desired size.

A moment's glance at the model furnishes a sufficient answer to the objection of the want of practical value. It would be passing strange if a machine of that character could have gone through the severe conflicts of litigation which this patent has encountered and have come forth victorious from every contest. It has proved equal to every ordeal to which it has been subjected. The number sold by the complainant, as shown by the record, is conclusive upon the subject.

The patent to Hobbs & Brown of the 4th of September, 1849, and the patents to Hamilton of the 30th of January, 1854, and the 5th of January, 1855, antedate the patent to Blake. It is insisted that each of them is for a machine substantially the same with the one described in Blake's patent, and that they are fatal to his claim of the requisite novelty of his alleged invention.

The machine for Hobbs & Brown is for—

Improvements in the application of well known mechanical means for the purpose of crushing ice. * * * The improvements consist in applying a hopper with one diagonal fixed side and two parallel sides to contain the ice, and compressing the ice by a movable fourth side, the fixed diagonal side and moving side having within them dental projections cut or cast on, to operate downward and prevent the ice from rising in the hopper when compressed, and also to enter and split the ice.

The machine is operated "by the combination with these parts of a lever fitted with an eccentric or cam-formed point."

There is in this description neither of the ingredients nor the compound of the Blake machine. Every element and the combination are both wanting. There is no mention of the converging adjustable jaws, of the revolving shaft, nor of the flywheel. The differences are as marked in the mode of operation as in the structural elements of the machine.

The Hobbs & Brown machine does its work by the downward and sweeping movement of the jaw and the grasping and splitting by the teeth. The motive power is supplied and applied by a hand lever, which gives a motion irregular and varying with the varying exigencies of the ice during the process to which it is subjected.

The Blake machine performs its functions by the short, regular, and unvarying vibrations of the smooth-faced adjustable jaw driven without intermission by the revolving shaft.

It is obvious that the Hobbs and Brown machine could not be applied with effect to the purpose of breaking stones without essential changes of principle and details.

Hamilton's machine was "for crushing and grinding quartz or other substances."

In the specification annexed to his original patent, he says:

My invention consists in the use of a cylindrical nut or pestle in a similarly formed basin, the pestle having a partial rotary and crushing motion communicated to it by means of a lever attached thereto.

A is a basin, the lower part of which is made circular, and the sides parallel to each other; *b b* are flat ends or heads secured to the basin by bolts. C is the shaft carrying the cylindrical pestle, *d*. E is a lever attached to or formed with the pestle, *d*, the upper end being connected by a joint, *2*, to a pitman, passing to a crank, *e*, eccentric, or other suitable mechanical contrivance to give the arm, *E*, an oscillating movement, and the pestle a partial rotary motion on its shaft, C.

The claim of this patent is for—

The means herein described and shown for crushing and grinding metallic ores, consisting of the cylindrical pestle, *d*, provided with grooves in its upper part to crack the lumps of ore and set a shaft, C, on which it has a partial rotary motion, and operating in connection with the basin, A, in which said pestle moves to grind the ore into powder by the gradual approach of the sides of said basin to the cylindrical pestle, said pestle being also provided with a scraper or agitator, *5*, in its lower surface to operate as specified.

The second patent is declared to—

Consist in providing means for keeping the pestle down with sufficient force to pulverize the material operated on, and also to prevent the pestle from grinding too finely, *i. e.*, to furnish material for simply cracking the ore or other material into small lumps of any desired size instead of grinding the same to a powder, thereby adapting the machine to different characters of metallic ores or other substances.

We have here no reflex or endorsement of either of the ideas that found expression in the Blake machine. The converging jaws, the revolving shaft, and the flywheel are all wanting, as in the Hobbs & Brown machine. Instead, there is a cylindrical nut or pestle, having a partial rotary and crushing motion communicated to it by means of a lever attached thereto. The pestle rotates on a central axis within an eccentric concave. The work is done by this pestle. There is nothing of the vibratory motion of a movable jaw, alternately advancing and receding, as in the Blake invention.

The difference is not that of mere mechanical equivalents. It is radical and goes to the essence of the organisms. These considerations are so obvious that further remarks upon the subject are unnecessary.

The proofs show that but two of the Hamilton machines were ever made. Practically the invention was abandoned.

This brings us to the question of infringement.

There are numerous points of similarity, and, indeed, of identity, in the respondent's machine, which are not controverted. It is for breaking stones. It has two upright jaws for this purpose, one fixed and the other movable. The jaws converge. The breaking is effected by the convergence. The movable jaw alternately approaches toward and recedes from the fixed one. This movement is produced by a short and powerful vibratory motion communicated by a revolving shaft by a flywheel upon it. There is an opening at the upper end of the jaws where the stones are received, and one below where they are discharged.

The only point of diversity insisted upon by the respondents is that the vibratory movement in the Blake machine is limited and unvarying, while in the machine of the appellants it is not of this invariable character.

In the Blake machine the movable jaw receives its movement from the revolving shaft through iron rods and levers. In the respondents' machine it is communicated from the revolving shaft through a confined column of water.

In the appellant's model the revolving shaft is not shown. In their machine it works the plunger of the pump from which the water is conveyed to a cylinder behind the movable jaw, whence it is applied to that jaw by means of a ram, the ram taking the place of the piston in an ordinary engine. Thus the vibrating arm, the toggle, the toggle joint, and the pistons in the Blake machine are dispensed with, and their place supplied by the hydraulic arrangements we have described.

What is so employed in the appellant's machine is the obvious and exact equivalent of what is so dispensed with in the Blake machine. The liability of the packed joints to leakage is a serious objection to such use of water. Any considerable leakage would stop the machine. It could not be used while that condition existed. Constant care and vigilance are necessary in such cases to prevent the frequent occurrence of this evil. Water does not escape from a safety valve with the same celerity or effect as steam.

The Blake machine has a decided advantage in the greater simplicity and cheapness of its equivalents.

It is difficult to resist the conclusion that the change had no motive or purpose but evasion.

If there be no extraneous obstruction, the vibratory motion will be exactly the same in both cases. If there be such obstruction, the safety valve in the appellant's machine might possibly be brought into use with good effect. But if this were so, the valve would be only an addition and an improvement of the machine. The valve, therefore, is, in any view, quite immaterial to the inquiry we are pursuing.

Where an original machine and an improvement upon it are both patented, neither patentee can use what does not belong to him without the requisite authority from the owner. The appellants have embodied all the ideas of Blake's invention in their machine, the valve which supplemented it, whether good or bad, is outside of the case, and cannot effect the result. We think the infringement is clearly made out.

It remains to consider the question of damages. A few remarks upon that subject will be sufficient.

The proof is meager and indefinite. The infringers made but four machines. No license fee charged by the complainant is shown. The burden of proof rests upon him. Damages must be proved; they are not to be presumed. The complainant made a profit of forty dollars an inch on the width of the jaws of the numerous machines he had sold.

But inventions covered by other patents were embraced in those machines. It was not shown how much of the profit was due to those other patents, nor how much of it was manufacturer's profit. The complainant was, therefore, entitled only to nominal damages. This the court gave him. It was all the state of the evidence warranted. It would have been error to give more.

The decree of the circuit court is affirmed. The costs of each appeal are adjudged against the party taking such appeal.

United States Circuit Court—District of Massachusetts.

PATENT LAMP.—CHARLES E. ASHCROFT VS. WILLIAM HOLLINGS.

[In equity.—Before Shepley, J.—Decided April 13, 1877.]

The patent for a lamp, can, or barrel, packed in part with an absorbent or finely granulated material, and over them a body of wire gauze or perforated thin plate, either rolled up like paper scrolls or put flat together like book leaves, is not infringed by the use of a lamp containing cotton covered with a layer of asbestos or porous fireproof cement, and covered with one thickness of wire gauze.

The invention patented to Wm. Beschke, August 14, 1866, includes as a necessary ingredient wire gauze or perforated thin plate in the form of scrolls or of layers like the leaves of a book.

OPINION OF THE COURT.

Shepley, J.:

The defense in this case is based upon the alleged want of novelty in the invention described in the letters patent granted to William Beschke and others, August 14, 1866, No. 37,245, "for an improved method of using explosive fluids for the production of light and heat," and also upon a denial of any infringement of the Beschke patent. The question of infringement depends upon the construction to be given to the Beschke patent.

In view of the state of the art at the date of the patent, as well as upon what is clearly described in his specification and claimed in his claims, it appears to be clear that the invention of Beschke is described and claimed as consisting in a lamp, or can, or barrel, packed in part with an absorbent or finely granulated material (excluding sand and including sawdust, cotton, beads, shot, gravel, asbestos, and their equivalents), and over them "a body of wire gauze or perforated thin plate, either rolled up like paper scrolls or put flat together like book leaves."

The defendant sells a lamp for heating purposes, manufactured under letters patent issued to Thomas W. Housh, May 4, 1875, called Housh's patent pocket cook stove. The lamp is made of metal, and is filled with cotton covered with a layer of asbestos, or of porous fireproof cement of which asbestos is an ingredient. The upper opening is covered with one thickness of wire gauze. There is no tube as distinguished from the body of the lamp, and there is no "body of wire gauze or perforated thin plate, either rolled up like paper scrolls or put flat together like book leaves."

Wherever in the Beschke patent wire gauze or perforated thin plate is alluded to, it is in the form of a scroll or of layers, like the leaves of a book, and after constantly repeating this description throughout the patent, and never using the words without some description of a scroll or layers, except in one instance, and then "wire gauze combined and shaped as mentioned," the patentee adds, "I disclaim also the simple use of mere wire gauze or perforated thin plate not rolled up like paper scrolls or put flat together like book leaves." The wire gauze or perforated thin plate, described in the claim of the Beschke patent, must be construed as referring to wire gauze or perforated thin plate rolled up like paper scrolls, or put flat together like book leaves, as described in the specification, and upon this construction of the claim in the patent the defendant does not infringe.

Bill dismissed with costs.

Recent American and Foreign Patents.

Notice to Patentees.

Inventors who are desirous of disposing of their patents would find it greatly to their advantage to have them illustrated in the SCIENTIFIC AMERICAN. We are prepared to get up first-class wood engravings of inventions of merit, and publish them in the SCIENTIFIC AMERICAN on very reasonable terms.

We shall be pleased to make estimates as to cost of engravings on receipt of photographs, sketches, or copies of patents. After publication, the cuts become the property of the person ordering them, and will be found of value for circulars and for publication in other papers.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED CAR AXLE BOX.

Edward L. Colman, Vandalia, Mo.—This relates to an improved car axle box, with anti-friction and self-oiling devices; and consists of the journal revolving in an elongated box, which is made of a top and bottom section, secured by bolted face and back plates. A number of friction rollers pass around the journal and around a guide channel below the same, taking up the oil by a bottom inlet from the outer box.

IMPROVED BRICK MACHINE.

Thomas McNicholas, Memphis, Mo., assignor to himself and Thompson Walker, of same place.—The moulds are similar to hand moulds, except that they have notches formed in their bottoms to receive springs attached to the bottoms of the channels in which said moulds slide, to hold them in place exactly beneath the discharge holes in the bottom of the mud box, and prevent them from being drawn back by the withdrawal of the pushers. The drive wheel causes pushers to bring the moulds beneath the discharge holes of the mud box, when the scrapers are in proper position to force out the clay, so that there may be no loss of time, and so that there may be no break in the passage of clay into said moulds to form imperfect or seamed brick.

IMPROVED LIFTING TONGS.

John T. Campbell, Rockville, Ind.—This is an improved device for lifting, carrying, dragging, or otherwise handling logs, timber, lumber, railroad ties, stone, etc., which is so constructed that it may be readily adjusted, as the character of the work to be done may require. It consists in a lifting tongs in which the handles are connected with the shanks of the jaws with an adjustable and reversible joint.

IMPROVED HAIR SPRING STUD FOR WATCHES.

Francis M. Martin, Cambridge, Ill., assignor to himself and John A. Hart, of same place.—This is an improved hair spring stud for the balance wheel of watches, by which the hair spring may be shortened or lengthened with great facility, and adjusted higher or lower, so as to be placed at a perfect level above the balance. The stud fastens to the hair spring without changing the same at the least at that point, so that it retains equal strength all around and moves in perfect isochronism. The invention consists of a stud, composed of a fixed and movable jaw, projecting downwardly, and clamped to the hair spring by a screw with tapering or eccentric head. The jaws are made to fit the curvature of the outer coil of the spring, so as to clamp the same without bending it out of its true shape.

IMPROVED CAR COUPLING.

Edward B. Middleton, Charleston, S. C.—When the cars are brought together, the projecting end of a hook enters the mouth of the opposite drawhead, strikes the beveled portion of a catch, raises the latter, together with its rod, and engages with the shoulder of a recess, thus completing the "lock" automatically. The parts are held so engaged so long as required by the gravity of the catch block.

IMPROVED RAILROAD TIE.

Alexander H. Campbell, Liberty, Ind.—This invention consists of a metallic cross tie of double T-shaped cross section, of which the bottom flange is cut out at the center. The tie is provided with sockets having bottom wedges for wooden filling blocks, retained by a central key driven down upon the wedge.

IMPROVED CUT-OFF OR VALVE FOR PUMPS.

Job Mansir, Richmond, Me.—This is a cut-off for the suction pipe of a pump, which is capable of making connection with either of two branch pipes, or both, as may be desired.

IMPROVED PIPE-CUTTING MACHINE.

Nehemiah Watson, Arcadia, R. I.—This invention consists, essentially, of a revolving circular saw, capable of cutting iron, and of a clamp for grasping the pipe and holding the machine in place during the forward feeding and cutting of the saw.

IMPROVED FLYING MACHINE.

Frank Barnett, Keokuk, Iowa.—This consists of a kite or horizontal sail provided with a boat or basket for passengers, which is placed on wheels, and is provided with propeller wheels for moving the apparatus, and with a device for guiding.

IMPROVED PITMAN CONNECTION.

Joseph Warren Blood, Minneapolis, Minn.—This is an improved pitman connection for that class of moving and reaping machines that have a hinged finger bar and tilting device. It is so constructed as to admit of the different movements which occur while in operation without binding.

IMPROVED CIRCULATING DEVICE FOR STEAM BOILER.

Henry S. Coleman, Chelmsford, Eng.—This consists in the employment in a boiler of circulating tubes suspended within the tubes connecting the two shells of the boiler. The said circulating tubes are straight vertical tubes of about half the sectional area of the outer tubes, and extend upward a short distance into the upper shell, and downward to the bottom. They are so supported as to be readily removable out of the way for cleaning the boiler, and for this purpose a rotating shaft is mounted, to which in the upper shell, all the tubes are connected, so that they may be raised simultaneously. The tubes are also constructed in two parts, one sliding within the other.

IMPROVED WINDMILL.

William Ap Williams, Cambria, Wis.—The object here is to diminish the friction in the working parts of the mill, and thus enable it to be run with a lighter wind than would otherwise be possible. The construction is such that the leverage is the same when lowering and when raising the pump rod.

IMPROVED BARK MILL.

William F. Mosser, Allentown, Pa.—This is an improved mill for grinding bark, provided with a safety device to prevent breakage should a foreign substance get into it. The breaker serves as a coupling, and is of such strength as to drive the runner under ordinary circumstances; but should any hard substance get into the mill, the collar will break and thus prevent the mill from being injured.

IMPROVED TURBINE WATER WHEEL.

Nathan H. Gould, Oakfield Centre, Mich.—This is an improvement in the class of water wheels having guides for directing the water against the buckets. The disk or surface of the throat plate is flat and smooth, so that little impediment is offered to the free passage of the water through the outlet holes, and the guides are so constructed as to aid materially in directing the water at right angles against the buckets of the wheel.

IMPROVED BOOT AND SHOE SOLE TRIMMING MACHINE.

William E. Forster and Willard C. Tolles, Nashua, N. H.—This consists of a revolving cutter in combination with a feed table and adjustable gauge. The cutting knife is keyed to the shaft in such a manner as to be readily taken off for sharpening, and projects about the thickness of the sole or heel above the table on which the boot or shoe rests. The table is provided at the front part with a straight or concave throat plate, on which the sole or heel of the shoe rests when being exposed to the action of the knife. The shoe is run along the gauge, which bears against the upper of the shoe, the heel or sole being turned on the throat plate and trimmed off by the cutter.

NEW MISCELLANEOUS INVENTIONS.

IMPROVED ICE CREAM FREEZER.

John Salter, Baltimore, Md.—This invention relates to an improvement upon that form of ice cream freezer having a stationary scraper in a revolving cylinder, which scraper is held stationary by its connection with a top plate, while the cylinder is revolved through a horizontal shaft with a bevel wheel that engages with corresponding beveled teeth on the top or cover of the cylinder. The improvement consists mainly in making the horizontal drive shaft hinged or jointed, and fixing its outer extremity in an outside independent bearing, so that the inner portion of the shaft with its bevel wheel and the top plate of the freezer may be together lifted off the tub and supported away from the same whenever it is desired to remove the cylinder or inspect its contents.

IMPROVED FILTERING APPARATUS.

James Gaiety, Augusta, Ga.—It consists of an adjustable plunger, to effect the compression of the filtering material in adapting the device to filter under varying degrees of pressures, in combination with the means for passing the water through the filtering chamber in the opposite direction to cleanse the filter without reversing the position of the same. It also further consists in locating an expansible spring directly in the filtering material, so that when the pressure of the plunger is relieved the movement of the spring in expanding loosens up the filtering material to adapt it to be thoroughly cleansed by the passage of the water through it. The apparatus is designed to be used in both double and single form, and is adapted to all kinds of filtration, but more especially to the filtering of water for household purposes.

IMPROVED LADLE FOR METAL FOUNDING.

William Fawcett, Omaha, Neb.—In the manufacture of car wheels, iron of high specific gravity has to be used in order to procure the necessary depth of chill. In wheel foundries a large ladle holding from five to ten tons of molten metal is placed in front of cupola and allowed to run full before pouring off. During the time of melting and casting, the hard, dense, and close metal will settle to the bottom by its own gravity, while all impure and light metal will rise to the surface. The wheel cast with metal from the top cannot have the proper chill, while those cast from the bottom iron are so hard and brittle as to be unsafe to be placed under a passenger car. By drawing the metal first from or near the bottom, a uniform chill is procured all through the heat, and to this end the invention consists in constructing the ladle with a vertical conduit in the side thereof, which opens into the bottom of the ladle, so that as the latter is tilted the purer and denser metal at the bottom of the ladle passes up said conduit and discharges first into the mould, leaving behind the lighter metal and the scoria floating in the top of the ladle.

IMPROVED SAFETY POCKET.

Frederick Wendt, Utica, N. Y.—This consists of a pocket having a small interior pocket of the inner top part, in connection with a top flap, fitting into the small pocket, so as to close or open the main pocket.

IMPROVED ROWLOCK.

William Spelman, Portland, Me.—This rowlock is so constructed as to diminish the friction between the oar and lock. It is made square, with its corners cut off, and there is an opening in its rear upper corner for the blade of the oar to be passed through. It is journaled to a block which is suitably pivoted to the gunwale.

IMPROVED HOP DRYER.

Samuel R. Templeton, John C. Templeton, and Joseph H. Templeton, Brownsville, Oregon.—This is an improvement in the class of drying apparatus in which a furnace and fan blower are combined, the one to impart heat and the other to impel the heated air through or in contact with the substance to be dried. The hops to be dried are placed upon a cloth, laid upon racks in layers of any desired thickness, so that the hot air may be forced up through them, expelling the moisture and drying the hops quickly.

IMPROVED REAR SIGHT FOR FIREARMS.

Charles F. Robbins, Brooklyn, N. Y.—This is a gauge for adjusting the rear sights of rifles from a zero point to the maximum of windage, at either right or left hand.

IMPROVED VERMIN TRAP.

Jean M. A. Berger, Charleston, S. C.—This consists of a frame or base of willowware, provided with boards having proper interstices attached to cross strips in close proximity to the willow frame. The trap is placed in position either at the head or foot end of the bed, or between the mattress and slats, or between bedstead and bedding, or at any other place where the insects are apt to congregate. The bugs, roaches, or other vermin are attracted by the large number of recesses and cavities of the trap, and are fond of hiding in the same.

IMPROVED CIGAR CUTTER.

H. Friedrich Schultze, Philadelphia, Pa.—This is an improved device for cutting off the points of cigars by the use of one hand only, the tips being dropped into a storage receptacle. It consists of a storage receptacle having a swinging and guided lid, with gauge holes for the points of the cigars, and resting on a spring cutting-knife, that passes below the gauge holes and cuts off the points by pressure on the lid.

IMPROVED FOUNTAIN PEN.

Henry N. Hamilton, White Plains, N. Y.—This fountain pen is so constructed that it may receive and hold enough ink to write one or more pages of manuscript. It also may be adjusted to let down the ink more or less freely, and it may be carried in the pocket, if desired.

IMPROVED ENGRAVING MACHINE TABLE.

Augustus E. Ellinwood, Garrettsville, O.—This is a table for holding the patterns or forms used in engraving machines by means of an elastic lip, secured in a groove in the table, which receives one of the edges of the pattern, and a longitudinal slot that receives a lip formed on the other edge of the pattern.

IMPROVED SHOTBAG AND CHARGER.

Thomas J. Jolly, Etna, Mo.—By this shotbag and charger any given quantity of shot may be uniformly and quickly taken out from the bag for the purpose of loading shotguns. The bag has a perforated bottom and a sliding pivoted plate, with a downward extending tube, having a bottom flange, interior charger, and plug fitting into the bottom hole to close the same and lift the charger.

IMPROVED BOOT OR SHOE.

Thomas J. Greenwood, Warren, Ill., assignor to himself and Thomas D. Thornton, of same place.—This is an improved seamless-back shoe. It has a quarter, which is cut of one piece of leather, along a center line and symmetrical curved side lines, and with holes near the highest point of the instep, to produce front sections and back tongue. The front sections are spread or sprung forward, and a top quarter of corresponding shape is placed between the same and stitched to the edge of the quarter. In this manner a shoe with seamless back is produced that may be made with any style of top quarter or vamp.

NEW TEXTILE INVENTION.

IMPROVED STOP MOTION FOR LOOMS.

Fred. Christen, Homestead, Iowa.—The object of this invention is to provide a simple and effective web stopping device for fancy looms using two or more colors of thread. It consists in a novel arrangement of fingers, between which the filling passes as it runs out of the shuttle, one, series of which, on the breaking of the filling threads, moves so as to actuate a stopping device. The improvement is designed for that class of looms that weaves fabrics from threads of several colors, which are introduced into the warp in succession; and it is intended for stopping the loom or the pattern-forming mechanism of the same.

NEW AGRICULTURAL INVENTIONS.

IMPROVED STUBBLE GUARD FOR PLOWS.

Benjamin F. Phillips, Lowden, Iowa, assignor to Nicodemus Henry, of same place.—This is an improved device for clearing a plow of stubble, weeds, and other trash. By it the plow can be cleared by the plowman while standing erect in his place, and without stopping the team. It is a pivoted bar, attached to the beam, having pronged ends which rest on the mouldboard. It is operated by a suitable lever.

IMPROVED CULTIVATOR.

John Rhodes Tilley, Demerara, British Guiana, South America.—The new features include means to enable the plows to be raised from and lowered to the ground, and adjusted to work at any desired depth in the ground. Also devices whereby the cutting knives are given a slow rearward motion beside that caused by the forward progress of the machine.

IMPROVED STRAW CUTTER.

Eric M. Hesselbom, Riceford, Minn.—This machine for cutting straw and hay for feed for stock is so constructed that the straw or hay will not be fed forward when the knives are cutting. It may be readily adjusted to cut the feed coarse or fine.

IMPROVED SULKY PLOW.

Albert A. Fowler, Plano, Tex.—This invention relates to the construction and arrangement of parts whereby the tongue and connected devices may be adjusted laterally according to the number of plows employed at one time, or according to their respective positions when used; also, whereby the plow beams are held rigidly parallel, although adapted for adjustment laterally and allowed free vertical movement.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED METHOD OF FORMING BLANKS FOR BOOTJACKS.

Henry A. Brown, Toledo, O.—This consists of taking a continuous strip of wood of suitable length, and of the width and thickness of the main piece of the common bootjack, and cutting the same alternately at suitable oblique angles, so as to produce separate pieces with tapering ends and a thicker intermediate point or seat for the cleat. The tapering ends of the bootjack allow the more convenient packing for shipment.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion. If the Notice exceeds four lines, One Dollar and a Half per line will be charged.

Spy Glasses and Telescopes of all kinds and prices. Lenses for making the same, with full directions for mounting. Illustrated priced circular free. McAllister, Manufacturing Optician, 49 Nassau St., New York.

Reliable Oak Leather and Rubber Belting. A specialty of Belting for high speed and hard work. Charles W. Army, Manufacturer, Phila., Pa. Send for price lists.

How to make Violins—Write J. Ranger, Syracuse, N.Y.

Shaw's Noise-Quelling Nozzles, for Escape Pipes of Locomotives, Steamboats, etc. Quells all the noise of high pressure escaping steam without any detriment whatever. T. Shaw, 915 Ridge Ave., Philadelphia, Pa.

Reliable Information given on all subjects relating to Mechanics, Hydraulics, Pneumatics, Steam Engines, and Boilers, by A. F. Nagle, M.E., Providence, R.I.

For 13, 15, 16, and 18 in. Swing Screw-Cutting Engine Lathes, address Star Tool Company, Providence, R.I.

For Sale.—Second-hand 4 Sided-Moulder, with about 300 knives; good as new; price \$500. T. R. Bailey, Agt., Lockport, N.Y.

Will A. T. S., who advertised June 9 for a Manufacturing business, address Box 1021, Providence, R.I.

Wanted.—A partner with about \$7,500 in a Manufacturing concern; no competition; will pay 25 to 30 per cent. on investment. Address E. Y. M., Pittsburgh, Pa.

Combined Miller and Gear-Cutter; capacity large; almost new; a bargain. C. A. Conde & Co., Phila., Pa.

For Boulton's Paneling, Moulding, and Dovetailing Machine, and other wood working machinery, address B. C. Machinery Co., Battle Creek, Mich.

John T. Noye & Son, Buffalo, N.Y., are Manufacturers of Burr Mill Stones and Flour Mill Machinery of all kinds, and dealers in Duffett & Co.'s Blasting Cloth. Send for large illustrated catalogue.

Steel and Iron Set Screws, manufactured by L. F. Standish & Son, New Haven, Conn.

Electric Gas Lighting Apparatus, applied to public and private buildings. The latest improvements. A. L. Bogart's patent. Address 702 Broadway, N.Y.

Patent Taper Sleeve Fastening and Wooden Pulley Works are now in full operation. Orders solicited. Satisfaction guaranteed. A. H. Gray, Erie, Pa.

Painters, etc., get circular, prices, etc., of New Metallic "Wiping out" Graining Tools; 75,000 now in use. J. J. Callow, Cleveland, O.

Removal.—Fitch & Meserole, Manufacturers of Electrical Apparatus, and Bradley's Patent Naked Wire Helices, have removed to 40 Cortlandt St., N.Y. Experimental work.

Power & Foot Presses, Ferracute Co., Bridgeton, N.J.

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

Lead Pipe, Sheet Lead, Bar Lead, and Gas Pipe. Send for prices. Bailey, Farrell & Co., Pittsburgh, Pa.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing metals. E. Lyon & Co., 470 Grand St., N.Y.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, N.Y.

Steel Castings from one lb. to five thousand lbs. Invaluable for strength and durability. Circulars free. Pittsburgh Steel Casting Co., Pittsburgh, Pa.

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

Split-Pulleys and Split-Collars of same price, strength and appearance as Whole-Pulleys and Whole-Collars. Yocum & Son, Drinker st., below 147 North Second st., Philadelphia, Pa.

Small Fine Gray Iron Castings a specialty. Warranted soft and true to patterns. A. Winterburn, 16 and 18 De Witt St., Albany, N.Y.

Articles in Light Metal Work, Fine Castings in Brass, Malleable Iron, &c., Japanning, Tinning, Galvanizing. Welles' Specialty Works, Chicago, Ill.

Book Binders' Case Binding Machine. Send for illustrated circular. Frank Thomas & Co., Cincinnati, Ohio. Skinner Portable Engine Improved, 2 1/2 to 10 H. P. Skinner & Wood, Erie, Pa.

Yacht and Stationary Engines, 2 to 20 H. P. The best for the price. N. W. Twiss, New Haven, Conn.

All nervous, exhausting, and painful diseases speedily yield to the curative influences of Pulvermacher's Electric Belts and Bands. They are safe and effective. Book, with full particulars, mailed free. Address Pulvermacher Galvanic Co., 22 Vine St., Cincinnati, Ohio.

To Clean Boiler Tubes—Use National Steel Tube Cleaner, tempered and strong. Chalmers Spence Co., N.Y.

Territory, on a Useful Household Article, given away free. Address Ezra F. Landis, Lancaster, Pa.

More than twelve thousand crank shafts made by Chester Steel Castings Co. now running 8 years' constant use prove them stronger and more durable than wrought iron. See advertisement, page 328.

Diamond Planers. J. Dickinson, 64 Nassau St., N.Y. Emery Grinders, Emery Wheels, Best and Cheapest. Hardened surfaces planed or turned to order. Awarded Medal and Diploma by Centennial Commission. Address American Twist Drill Co., Woonsocket, R.I.

Notes & Queries

C. N. will find a table of the prices of metals on p. 169, vol. 33. As to powerful explosives, see p. 2, vol. 34. As to the most deadly poison, see p. 155, vol. 31.—A. K. will find something on the properties of selenium on p. 241, vol. 30.—C. C. C. is informed that the *Textile Manufacturer* is published in Manchester, England.—G. H. W.'s query was answered under the initials G. H. M., p. 268, vol. 36.—A. A. can calculate the

horse power of his engine by the formula given on p. 33, vol. 33.—F. E. M. will find something on removing moles or freckles from the face on p. 374, vol. 32.—J. A. McN. will find an explanation of the apparent variation in the size of the moon's disk on p. 305, vol. 34.—B. L. D. should use crude or pure rubber in the preparation of marine glue.—C. W. I. will find directions for removing mildew from cloth on p. 250, vol. 34.—R. should consult his family physician.—D. S. R. will find on p. 30, vol. 30, directions for deodorizing cod liver oil.—W. C. R.'s query as to gas cylinders for calcium light is answered on p. 380, vol. 36.—A. M. will find that the claims of the Keely motor people are fully exposed on p. 400, vol. 32.—P. W.'s query as to weight near the surface of and in the depths of the ocean is answered on p. 363, vol. 36.—J. C. B. will find good tables of logarithms in Culley's "Handbook of Telegraphy."—J. L. C. will find directions for building an aquarium on p. 90, vol. 30.—G. C. will find directions for tempering small drills on p. 85, vol. 33.—T. J. S. S. will find a formula for the width of belts on p. 58, vol. 37.—J. G. K. will find the address of the inventor of the calculating machine in the article describing it.—E. L. L. F. will find an article on watermelon sugar on p. 191, vol. 35.—C. P. will find full particulars as to the Great Eastern steamship on p. 346, vol. 31.—S. A. E. will find something on utilizing mica on p. 241, vol. 34.

(1) J. says: You recently informed a correspondent that you knew of no better way of pouring a Babbitt metal box, where the box is solid instead of being in halves, than by wrapping paper around the shaft to allow for shrinkage of the Babbitt metal. This slovenly plan has two objections. The paper is too thick to make the proper fit, and the metal shrinks on the paper and makes the box difficult to remove after pouring. Neat workmen warm the shaft and coat it with soap. But I have seen workmen make use of a plan so simple, so perfect, and so novel that I think it worthy the name of a wrinkle. It is simply to place the box horizontally, pour it half full, and let it cool. Then pour the other half. The result is a solid box in halves. The metal will be found to fill the casting solidly and not to have shrunk on the shaft.

(2) J. O. C. says: I have a wood lathe, bed made of 4x14 inches oak timber, head and tail stock of wood, with a cast steel head spindle with 1 1/4 inches bearing, 4 inches long. In turning wagon hubs, the lathe runs smoothly and without jar. Please let me know if I can turn iron on the lathe by using a hand slide rest? A. Yes.

(3) G. H. asks: What particular bones of the whale supplies us with the article of commerce known as whalebone? A. Whalebone is not, as its name might seem to signify, obtained from the bones of the whale, but from a substance which forms a substitute for teeth in the Greenland and other whales. This substance consists of flat plates or blades, hanging from the sides of the upper jaw (occupying the position of teeth in other animals). They are usually about 300 in number on each side, and are arranged parallel with each other, at right angles to the jaw. They are usually, at the middle of the jaw, about 9 feet in length. A full sized Greenland whale yields about 1 ton of these.

(4) W. E. G. asks: At what part of the crank stroke of an engine should the slide valve open the ports? A. The port should be about 1/4 inch open when the crank is on the dead center.

(5) G. W. S. says: I am about completing an invention that requires the use of a small cord, not to exceed 1 1/4 inches in circumference. I would prefer that it should be 1 1/4 inches in circumference, and desire it to sustain strains of at least 400 lbs. I do not think wire can be made to answer, and wish to know what is the best material in a rope or cord of the two dimensions? What are the breaking and safe strains of such cords? A. Good hemp rope, of either size mentioned, can be made of the requisite strength. Silk cord can be made much smaller. You should apply to manufacturers for prices.

(6) H. B. says: I am engaged in file cutting and have considerable trouble from the files cracking in tempering. In 170 gallons of water used for tempering, I use the following ingredients: 1/2 pint oil of vitriol, 1/2 lb. alum, 1/4 lb. borax, 1/4 lb. prussiate of potash, and have the water salted so that a potato will float on it. What additional ingredients must be used, or what can be done to prevent the files cracking? A. Your files are probably heated too high. Try heating lower, and dip vertically.

(7) F. S. says: We have a four horse power caloric engine, which we would like to run with oil. We now run it with anthracite coal, which costs us \$10 per ton, and the air passing through the fire deposits so much grit in the cylinder as to cut out the packing ring and the cylinder in a short time. Which would be the cheapest, coal or oil? And if the latter, which would be the best kind of oil? A. We advise you to confer with the manufacturers.

We have a cistern built in clay ground; after having finished it, we found that water had made its way in. Thinking that it was not cemented enough, we put on 6 or 7 coats; but water still comes through. What can be done with it? A. We could not tell without knowing more particulars. If there is a spring in the neighborhood, it may be necessary to give it another outlet.

We have an iron roof on our factory which sweats in frosty weather, the sweat dripping down on the machinery. What can we put on to prevent it? A. You should either ventilate and heat the building more effectively, or cover the iron with some non-conducting material.

(8) C. H. M. says: I have a 12x14 inches engine. The steam follows the valve 10 inches. I am about putting in new valves, and am thinking of using more lap so as to make the valve cut-off earlier. Of course the exhaust will open the same, but will close earlier, unless I make it open very early. I want to know whether there will be any gain in so doing? A. You will gain by giving your valve sufficient lap to cut off the steam at about 3/4 stroke.

(9) T. R. W. asks: What is the best disinfectant for kitchen drains, cesspools, etc.? A. Use

chloride of lime (hypochlorite of calcium), or carbolic acid.

(10) E. M. L. asks: How can I utilize small scraps of tortoiseshell? A. Small pieces of good tortoiseshell may be joined so as to form one large apparently seamless piece in the following manner: Slope off the margins of the shells for a distance of about a quarter of an inch from the edge. Then place them so that the margins overlap one another; and thus arranged put them in an iron press and immerse in boiling water for some time. The pieces by this means become so perfectly united that the joint cannot be seen. The filings and very small scraps may be softened in hot water and consolidated by hydraulic pressure in metal moulds. Protracted heating of tortoiseshell darkens it, and greatly lessens its beauty.

(11) J. H. B., of Leeds, England, says: I require a peculiar kind of cement. I have used plaster of Paris and white lead, which, when moulded and hot pressed, forms into a very hard substance; but it rubs off on to fabrics when being pressed on to them in a chamber containing steam. Can you suggest anything that will keep the white from rubbing off? A. You might try a wash of strong alum solution. Perhaps a better cement for the purpose would be that made with lime and alumen. Slake freshly burnt lime with boiling water; this occasions it to fall to a very fine dry powder, if excess of water has not been added. White of egg or blood albumen should be intimately mixed by beating with an equal quantity of water; and enough of the lime powder should be added to form a thin paste, which should be used speedily, as it soon sets. This is a valuable cement, possessed of great strength, and capable of withstanding steam or boiling water.

(12) M. A. says: We have a lot of plated spoons that are discolored with a bluish purple cast resembling that on tempered steel. We fear to injure the polish. Can you tell us how to clean or remove the color without injuring the polish? A. The discoloration is very probably due to the formation of a film of sulphide of silver. This may be removed by dipping for a moment in strong nitric acid, and then washing immediately in running water. If the silver is permitted to remain in contact with the acid for more than a moment or two, the polished surface will be injured, so that it is preferable to rub off the film with a little finest tripoli powder and a piece of chamois skin or a soft brush.

(13) C. W. G. asks: How do you account for the fact that some of the genuine fifty and twenty-five cent pieces have not the ring of true metal? I sometimes see coins that, when thrown upon a counter, sound like lead; and yet they stand all the other tests, and are to all appearances genuine silver coin. A. It may be attributed to some flaw, crack, or strain due to distortion. Most of the non-sonorous coins in circulation are not genuine.

(14) P. M. B. asks: How can I remove an oil stain from granite, caused by having left some fresh oil putty on the same? A. Moisten the spot with bisulphide of carbon, and immediately cover it with dry pipeclay or kaolin.

(15) E. P. H. says: I have a bronze mirror, and it has become dull and a little defaced by handling. I cannot find anything that will restore the polish. Can you tell me what to do with it? A. Rub it over with a cloth moistened with dilute sulphuric acid; wash with water, dry, and polish, first with finest tripoli, and then with putty powder on a piece of chamois skin.

(16) A. C. A. asks: How can flowers be wrapped up so that they can be sent by mail without wilting? What is the best way to send roots and plants by mail? A. Dip them for a moment in dilute glycerin and pack loosely in cotton (moist) in small pasteboard boxes. Roots or bulbs should be wrapped as tightly as possible in a strip of cloth moistened with a mixture of about 1 part glycerin to 3 parts water, and packed in small pasteboard boxes.

(17) C. H. says: Can you give full particulars of the preparation of powder paper? Would it explode under pressure, without ignition? A. It is very probable that it would. We have not tried the experiment.

(18) T. H. L. asks: Do all animals above fishes perspire through the entire surface of their bodies? A. To a greater or less extent, this is, we believe, the case with all of the higher animals.

(19) R. S. H. asks: What will take the stain of apple juice out of white cambric muslin? A. Rub the spots well with strong alcohol, and then moisten with a little very dilute sulphuric acid (1 part acid to 30 parts water), and cover with moist bleaching powder (chloride of lime) until the spots disappear. Finally, wash well with soap and water.

(20) W. H. J. says: I have a parchment diploma that has hung against a brick wall till it has become wrinkled from gathering moisture. How can I make it smooth again? A. Cover it on both sides with bibulous thin blotting paper, and pass a warm iron over the reverse side until it is properly smoothed.

(21) M. B. H. says: I am sprinkling the streets with a 300 barrel tank, from which I fill my wagon, which holds 19 barrels water. Can you tell me how much chloride of calcium would be necessary to keep the dust down, going over the ground two or three times a day? Would it be better to put the chloride into the large tank or the small one? A. We think the smallest quantity to be used is about 1 lb. to the barrel (= 1/2 oz. to 1 gallon). If you can make sure of its complete solution, you had better add it in the small tank.

(22) C. T. L. says: In making fly paper, I wish to put a preparation of sticky materials on calendered writing paper. On one side, I put an extra sizing of glue; but I cannot spread it evenly, and it stains through the paper. A. Use a sizing of a thin solution of shellac in borax, or dip the paper for a moment into a solution of beeswax in methyl alcohol, and then pass

it between hot rollers. The sheets may then be glued by laying each sheet, face downward, on the surface of the bath.

(23) H. M. H. asks: What are the chemical changes produced on the photographic plate from the time the collodion is flowed on to the time the fixing solution is washed off? And what are the lights and shades composed of before and after the plate is fixed? A. Upon putting the collodionized plate into the silver bath, the iodides or bromides contained in the collodion cause a precipitation of insoluble iodide or bromide of silver on the collodion. On exposing this to light, a partial reduction of these salts ensues wherever the light strikes it—the stronger the light the greater the reduction—and this reduction is in so far completed by the action of the developer that the parts exposed to light become insoluble in the fixing solution (hyposulphite of soda or cyanide of potassium). Before fixing, the shades are composed of basic salts and oxide of silver, the lights of unreduced salts. In the fixing bath all of the unreduced salts are dissolved out, while the rest remains unchanged. The lights in the finished negative are therefore the transparent portions.

(24) F. P. asks: How can an aqueous solution of Liebig's extract of beef be prepared? A. Dissolve 1 part extract in about 30 parts warm water.

(25) H. L. C. says: I wish to make some permanent U magnets of cast steel, of 3/4 x 1 inch bar. They are to be 7 inches long, and capable of supporting 8 or 10 lbs. Can I charge them by using an 18 by 1 inch round iron formed into a U shape, and wound with 75 feet of No. 14 cotton-covered wire, with battery power consisting of two Hill cells? A. Yes, but one Grove or carbon cell would answer better.

(26) B. says: I have a cistern which is made in clay ground; and it lets in water through the cement, and makes the rain water hard. It has 6 or 7 coats of cement, and still the water comes through. What is the reason, and how can I prevent it? A. No kind of cement that is mixed with water can be depended upon absolutely to make a lining impervious to water. You require an asphaltic cement put on in several coats, and fortified and loaded down with a brick or concrete bottom and sides, to keep it in place, so as to resist the pressure of the exterior water when the cistern is not filled.

(27) F. D. H. asks: In connecting the coils of an electromagnet, which are the proper ends of the wire to join, those nearest the cores or the outside ones? A. It is usual to join those nearest the core.

(28) J. C. W. asks: How can I build a hot-house of lumber, for flowers in the winter? A. Locate it so as to harmonize with surrounding buildings, but place it so as to front either south, southeast, or east. Let the front wall be 2 feet above the ground, and the rear wall sufficiently high to give the glass roof a slant of 45°—the height depending upon the width of the building. If the soil is dry, the floor may be sunk 2 feet below the surface of the ground by excavating to that depth. If you have stone, build foundation walls 18 inches thick up to 6 inches above surface of ground, lay sills around and set your posts about 4 feet apart, their size being 4 by 4 inches. Cover the front and rear, both on the exterior and interior, with tongued and grooved boards, and pack the 4 inch space between the boarding with dry sawdust or wood shavings rammed close. If you have no stone, use locust or chestnut posts, driven well into the ground and sawed off level for the sill. Make your rafters of sufficient size to suit the width of the building, and placed so as to properly receive your glass frames, and provide in the 2 feet wall at bottom, and in the upper row of sashes, a ventilating shutter to every other opening between the rafters. Put the door in the warmest end, and construct the ends of glass. To provide against severe weather, procure a hot water greenhouse stove and pipes, and set the same according to the directions given.

(29) J. W. S. says: A house that cost \$15,000 caught fire from a chimney; the gas had eaten the mortar away from the bricks. Is there anything that can be put in mortar that will counteract the effects of the gas? A. Make your mortar of lime and clean sharp sand (no clay or loam); make the walls of the flues fully 4 inches thick, and fill the joints of the brickwork with the mortar properly, and there will be no danger of the gas eating through the mortar to set the house on fire.

(30) J. J. says: A large reservoir 20 feet deep, 2 miles from town and 200 feet above town, has two pipes equal in size and length. One is inserted at bottom of lake or reservoir, the other near the top; and both are led to the same point in town. Which would supply water first or run the most? What would be the difference if the top pipe were connected to a small box three feet square which is kept supplied with water at the same height as the reservoir? A. The head of water, or the pressure at the bottom of the pipe in town, is the same in both cases, the only difference being in the length of time that the supply would continue—the pipe which connects near the top of the tank ceasing to flow when the water subsides to that point, but the other continuing until the tank is fully discharged.

(31) B. & C. F. say: 1. We propose building a storehouse. We desire to know which is best, brick or stone, stone being white sandstone of good quality and the brick medium? A. The brick wall could be laid up in less time than stone and would answer of less thickness—it would therefore most likely be more economical; it would also stand fire better. 2. Which is best for roofs, tin or sheet iron? Should it be painted? A. A roof of light I.C. plate charcoal tin is the best; and it should be painted 2 coats of best yellow ochre paint.

(32) A. G. says: I got some small articles for silver plating, and tried your recipe given on p. 299, vol. 31, but without success. The articles are of a composition of tin, zinc, and lead or antimony, 1 to 2 inches long and 1/4 inch wide. How can I succeed? A. Probably you were not careful enough in cleaning the objects. Try boiling and rubbing them in a solution of caustic soda, made by boiling about 2 lbs. of common

soda crystals with milk of lime, produced by slacking 1/4 lb. of quicklime with hot water well stirred; then rinse them in a fresh caustic soda or potash solution and transfer immediately to the silver bath.

(33) V. & G. say: 1. We cut off steam at 8 inches on one end and 10 inches on the other end of our 14x28 inch cylinder. Is this right? We find that if we make it cut off alike on both ends that the valve opens wider on one part than the other. A. It is impossible in a common slide valve to make the points of admission cut off and release equal for each stroke; and it is preferred to keep the points of admission equal. 2. There is about 1/4 of an inch space between the cylinder head and the follower. Would we save any steam to make our cylinder head thicker and reduce this space? And if so, how much space should there be? A. Yes. About 1/4 inch. 3. Is a variable cut-off valve, working on the back of the main valve, better than to vary the cut-off of the main valve by raising or lowering one end of the eccentric rod on an arm? A. It is considered so.

(34) L. H. R. asks: 1. In electricity, what is an ohm, and why is it so called? A. The ohm is the unit of resistance in electrical measurements. It is equal to the resistance of a prism of pure mercury, one square millimeter in section, and 10496 meters long, at 0° C. The name ohm was given the unit in honor of Dr. Ohm, a celebrated physicist. 2. In chemistry, which of the two metals, zinc and lead, has the greater affinity for silver? A. Zinc.

(35) A. H. R. says: I wish to make a pair of waterproof pants, in which to work in water from 6 to 10 hours at a time, without getting wet through. Will twilled cotton, thoroughly coated with raw oil, answer the purpose? Or is there any better coating? A. No. Try a mixture of about 10 parts boiled oil and 1 part beeswax, thinned down so as to readily penetrate the cloth. A better way is to use a thin varnish made by dissolving India rubber in bisulphide of carbon containing about five or six per cent of absolute alcohol. A very thin coat of the varnish will answer, and is cheap.

(36) J. K. T. asks: Is there any way to shrink boots, which have been stretched while wet, into shape again? A. We do not know of any.

How can I polish a gun stock? A. Put on several good coats of shellac, rubbing each one down when dry with pumice stone, and finish with a fine linen wad kept constantly moistened with thin alcoholic shellac and occasionally a drop of oil.

(37) B. L. H. asks: Will you please inform me of the process of marbling iron? A. See article on enameling iron ware, p. 21, vol. 36. The variegated colors may be produced by the addition of oxide of antimony, manganese, and iron to the glazing, before the final fusion. This also answers W. M.

(38) A. R. S. asks: How can I get the impression of an article in plaster of Paris without the article becoming set in the plaster? A. If there are any inward curves or angles in the model you cannot make a correct cast of it at once. For intricate work the model must be in several parts, from each of which a separate cast is taken; and then all of them properly joined to form one mould. This subject has been dealt with in detail by Mr. Joshua Rose in late numbers of the SCIENTIFIC AMERICAN. Where the undercut curves or angles are not very sharp, it is sometimes possible to get a cast in glue, which, being more elastic than plaster, admits of a certain amount of compression and stretching in removing the pattern. The water in which the glue is dissolved is mixed with enough glycerin to retain the glue as a stiff jelly on cooling. The patterns are carefully oiled before being brought into contact with the glue. From the first cast a second one, in glue, may be taken, and from this, in turn, a plaster cast, thus copying the first.

(39) T. W. asks: What is the best non-conducting material (for heat) whether of animal, vegetable, or mineral nature? A. Among substances of animal origin, feathers, wool, hair, silk, etc., are the best. Among vegetable substances, charcoal, sawdust, shavings, cotton, and dry fibers in general. All these, when dry, are excellent non-conductors. Of mineral substances, asbestos, mineral wool, porous tiles, and clay bricks, also slabs or bricks of porous infusorial earth, etc.

(40) N. M. W. asks: How can I clarify and polish horn? A. It is usually first scraped, and then rubbed down with emery powder and water, and finished with tripoli or rouge. In working horn, the bony core should first be removed by soaking in cold water for several weeks, which treatment loosens the core, so that it may be pulled out. Boiling water temporarily softens horn; and while soft it may be slit, and spread out by pressure between hot iron plates.

(41) A. L. B. says: In one of your papers I see a statement of the effect of sulpho-carbonate of potassium on the eggs of the potato bug. Would the application of this chemical to the field be likely to poison the potatoes, so as to make their use dangerous? A. No; but it may impart an unpleasant smell to some of the tubers, if used excessively.

(42) Z. H. asks: 1. Can grain nickel be melted in an ordinary furnace used for melting brass? A. If the furnace is provided with a very good draught, you may succeed in fusing small quantities of it at a time. It requires a very high temperature, and a long exposure in the furnace to get it liquid enough to run. 2. Will it run without an alloy? A. Yes.

(43) A. L. S., Queensland.—Remit 16 shillings sterling for SCIENTIFIC AMERICAN one year, which includes postage.

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

J. M. B.—A is properly an agate, of little value. B are pebbles of milky quartz and flint.—W. J.—It is a clay containing a considerable amount of infusorial silica. It is an excellent article for polishing purposes, and, if properly washed, might prove marketable.—J. H. C.—No. 1 is an indurated clay, contain-

ing much oxide of iron. No. 2 is a piece of red jasper. No. 3 is a felspathic rock, containing small specks of iron pyrites and chalcophyllite (sulphide of copper). No. 4 is nodular pyrites (marcasite). See p. 7, vol. 36. None of the specimens are valuable.—H. W. S.—It is mostly magnetic pyrites (pyrrhotine).—M. S.—No. 1. The coating contains manganese and very probably zinc. No. 2 is an earthy oxide of cobalt—a variety of No. 1. No. 3 is gneiss rock with sulphide of iron. No. 4 is magnetite.—F. H. P.—A is a piece of hornblende. B is gneiss rock, with a few iron garnets. The crystal is calcite—carbonate of lime.—M. W. R.—It is mica schist (a silicate of potash, alumina, magnesia, and iron) with chlorite (a hydrous silicate of magnesia, iron, and alumina).—K. H. R.—They are pebbles of flint, common agate, chalcedony, and quartz. We do not consider them valuable. Such pebbles can be found on most sea shores. It is impossible for us to say where the pebbles came from, or where similar ones could be found in quantities. We have seen magnificent agates from the Pacific coast, and we understand that they abound near San Diego, Cal.—E. E. E.—It is not coal, but clay containing a large amount of carbon.—C. A. M.—It is a wax, called by dealers Carnauba wax.

M. B. & R., of Melbourne, Australia, say: The greatest enemy that the fruit gardener has to contend with in this colony is the sparrow, and it seems a matter of great wonder that no means have yet been introduced to stop its ravages. Those who have not had ocular demonstration would scarcely credit that these little creatures could commit such havoc. Settling in flocks upon the choicest fruit trees, they will quickly completely denude them of every particle of ripe fruit. Here is an opportunity for the ingenious American to distinguish himself by inventing some contrivance to preserve the trees from their ravages. Of course the invention must also have the merit of cheapness, so as to bring it within the reach of all classes.

COMMUNICATIONS RECEIVED.

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

On Painting Axes. By W. E. W.
On the Dunkirk Microscopical Society. By C. P. A., and by J. E. S.
On the American Cicada. By H. H.
On a Discovery in Geometry. By L. S. B.
On Torpedoes. By J. P. W.
On Converting Motion. By F. S.
On a Decimal System of Computing Time. By C. E. D.
On Capital and Labor. By —.
On Boiler-Covering Composition. By P. C.
On Liquors. By C. F. F.
On Water Evaporated through Engines. By W. A. M.
Also inquiries and answers from the following:
C. M. K.—S. B. E.—A. J. B. B.—A. S.—J. M. W.—A. S. T.—J. E. B.—B. K. A.—W. O. W.—J. C. H.

HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Inquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of inquiries analogous to the following are sent: "Who makes machines for breaking down rice straw for paper-making? Who sells steam heaters, in which the heat may be readily varied to suit the wants of the household? Who sells electric candles, as described on p. 339, vol. 36? Who sells decorative tiles? Who sells hydraulic lime?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

OFFICIAL.

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were

Granted in the Week Ending

May 15, 1877.

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

Awl haft, N. B. Dit Lapine..... 190,747
Bag fastener, A. B. Cate..... 190,696
Bag machine, Arnold & Quigley..... 190,693
Baling press, J. E. Hanger..... 190,692
Bark mill, W. F. Mosser..... 190,777
Barrel trussing machine, W. Bayley..... 190,731
Basin, J. H. Keyser..... 190,706
Bed bottom, G. Eade..... 190,749
Bee hive, G. Kratzer..... 190,874
Bee hive, N. Zimmerman..... 190,917
Bessemer converter bottom, E. J. Mildren..... 190,890
Binder, hand, J. O. Brown..... 190,701
Binder, hand, J. O. Brown..... 190,702
Bird cage support, F. W. Long..... 190,881
Blackboard eraser, H. L. Andrews..... 190,692
Blackwashing device, N. K. Wade..... 190,697
Blind slot adjuster, H. Gaylord..... 190,847
Blowing machine, Cochran & Hendy..... 190,828
Blowing machine, J. W. Wilbraham..... 190,943
Bone black revivifier, J. Gandolfo..... 190,676
Books, binding, W. Gilliland..... 190,754
Boot and shoe, T. J. Greenwood..... 190,753
Boots, crimping, L. O. Meakepeace (r)..... 7,686
Boot uppers, crimping, I. H. & J. D. Spake..... 190,922
Bootjack blanks, forming, H. A. Brown..... 190,736
Bottle, composition seal, C. M. Chapin..... 190,805
Breech loading firearm, H. W. Jacobson..... 190,829
Bridge truss, J. H. Snyder..... 190,921

Bridge truss, J. H. Snyder..... 190,921
Bridle bit, F. B. Kuehnhold..... 190,876
Broom, A. Stephen..... 190,726
Brush, H. W. Champion..... 190,821
Brush handles, making, J. L. Whiting..... 190,941
Buckle, belt, W. Roemer..... 190,906
Bung and bush, combined, E. Rodler..... 190,926
Butter worker, Cornish & Curtis..... 190,707
Butter worker, G. Riddle..... 190,692
Cane and pipe, Hirsch & Ettinger..... 190,859
Car brake, I. R. Oakford..... 190,689
Car coupling, P. Hien..... 190,858
Car coupling, E. B. Middleton..... 190,775
Car coupling, G. M. Thompson..... 190,931
Car pusher, J. E. Gearhart..... 190,848
Car starter, C. A. Harvey..... 190,853
Car starter, L. Russell..... 190,909
Car starter, G. M. Thompson..... 190,930
Casting spear, F. J. Fox (r)..... 7,675
Casting, composition for, A. Kiesele..... 190,769
Chair, F. H. Foster..... 190,842
Chair back and seat, H. C. Knowlton..... 190,872
Chair, folding, H. Closterman, Jr..... 190,837
Chair, nursery, J. C. Wheeler..... 190,830
Chair, reclining, H. S. Smith..... 190,788
Change box, O. White..... 190,942
Churn, D. C. Chadwick..... 190,687
Churn, reciprocating, E. Brough..... 190,734
Churn, reciprocating, J. Clinedinst..... 190,705
Cider press, S. M. Ellis..... 190,713
Cigar, M. Gelston..... 190,849
Cigar cutter, H. F. Schultze..... 190,734
Claw bar, C. A. Miller..... 190,887
Cleaving up topsails, W. H. Dare..... 190,831
Clock dial, H. J. Davies..... 190,671
Cook, automatic, G. F. Hammer..... 190,690
Coin wrapper, G. Rettig..... 190,903
Corkscrew, M. L. Crannell..... 190,699
Corn planter, J. Rand..... 190,900
Corn planter, etc., L. E. Williams..... 190,944
Corn planter attachment, W. R. Cunningham..... 190,830
Corn sheller, E. S. McEwen..... 190,721
Cotton chopper, etc., E. C. L. Bridges..... 190,815
Cradle, J. L. Butler..... 190,817
Cultivator, J. R. Tilley..... 190,796
Cultivator, coupling, W. P. Brown..... 190,816
Darning last, M. B. Crowninshield..... 190,745
Dental chair, J. B. Morrison (r)..... 7,637
Desk, school, J. Peard..... 190,896
Desks, folding seat for school, O. Davis..... 190,832
Dish, culinary, S. W. Mathewson..... 190,638
Disks for stamper shanks, J. Cliff..... 190,698
Doffer combs, operating, E. R. Coverdill..... 190,744
Door check, I. J. Webber..... 190,939
Door stop screw, O. Mongeau..... 190,776
Ear slipper, I. B. Kleinhert..... 190,720
Eggs, desiccating, Stoddard & Flint..... 190,927
Electric light, carbon, P. Jablockhoff..... 190,864
Engine, rotary, T. F. Sparrow..... 190,623
Engraving machine table, A. E. Ellinwood..... 190,750
Fare register, P. Seyl..... 190,912
Feed cooking, steam, C. & W. Kramer..... 190,873
Fence wire, barbed, J. Dobbs..... 190,836
Firearms, rear sight for, C. F. Robbins..... 190,782
Fire escape, M. Durand..... 190,837
Fireman's belt, F. Costantino..... 190,829
Flying machine, F. Barnett..... 190,780
Fruit crate, J. H. Marvil..... 190,883
Fruit drier, J. R. Dodge, Jr..... 190,748
Fruit drier, Kelly & Cole..... 190,635
Fuel, artificial, W. C. A. Roettger..... 190,724
Furnace blower, etc., L. C. Cook..... 190,706
Fuse, percussion, B. B. Hotchkiss..... 190,861
Gage, J. K. Underwood..... 190,933
Gage, carpenter's, G. W. Vaughan..... 190,834
Gage, pressure, W. T. Snyder..... 190,730
Galvanic battery, C. R. Jennison..... 190,684
Gang edger, Evans & Snyder..... 190,840
Gas and water pipe cut-off, F. Jarecki..... 190,828
Gas burners, liquid, H. W. Dopp..... 190,673
Gas carburetor, C. A. Enggren..... 190,714
Gas furnace, C. W. Siemens..... 190,915
Gas holder, W. & R. H. Smith..... 190,918
Gas retort lids, fastening for, N. Jamin..... 190,867
Gate, automatic, J. E. Goldsworthy..... 190,715
Gate, farm, H. N. Dunbar..... 190,674
Gearing machine, Singleton & Wingfield..... 190,916
Gearing, screw, H. Hackman, Jr..... 190,679
Grain binder, G. A. Walker..... 190,936
Grain, curing, H. A. Beach..... 190,809
Grain separator, L. V. Davis..... 190,746
Grate bar, A. E. Barthel..... 190,805
Gun, spring air, O'Connor & Dinnan..... 190,839
Harness saddle loop, Monteith & Mesick..... 190,891
Harrow, F. M. Davison..... 190,833
Harrow, D. McCrevey..... 190,774
Harvester rake, J. H. Meyers..... 190,778
Hay elevator, G. Van Sickle (r)..... 190,681
Hay loader, J. W. & E. Small..... 190,725
Heddle frame, G. Crompton..... 190,708
Hinges, making, L. B. Gusman..... 190,850
Hoe, J. S. Lester..... 190,878
Hoisting and conveying, F. A. Clarkson..... 190,742
Hominy mill, G. B. Gains..... 190,675
Hoof parer, J. Hilger..... 190,682
Hop dryer, S. R. J. C. & J. H. Templeton..... 190,794
Hop extract, composition, J. R. Whiting..... 190,801
Horse hay rake, J. Badger..... 190,729
Horse hay rake, B. & E. F. Morse..... 190,892
Horse hay rake, D. W. Travis..... 190,696
Horse hay rake, H. C. Velle..... 190,835
Horsehoe, J. R. Cancio..... 190,740
Horsehoe bar, A. Barton..... 190,806
Hose to couplings, securing, S. Adlam, Jr..... 190,728
Hot air furnace, W. McFarland..... 190,773
Hydraulic motor, J. M. Bois..... 190,700
Incrustation, removing, H. H. Kreamer..... 190,770
Insect destroyer, C. H. Emerson..... 190,838
Iron, manufacture of, W. H. St. John..... 190,936
Jar cover, closing, T. A. Weber..... 190,940
Knitting machine, J. M. Slack..... 190,694
Knob, metal, A. B. Hendryx..... 190,835
Lamp, L. H. Olmstead..... 190,894
Lamp burner, E. C. Lawrence..... 190,877
Lamp chimney, J. McMurtry..... 190,886
Lamp chimney, shade, etc., G. W. Martin..... 190,892
Lamp, safety collar, J. H. Lewars..... 190,879
Latch, closet, W. E. Sparks..... 190,792
Leather, stretching, J. Sharp..... 190,693
Lifting jack, I. D. Johnson..... 190,718
Liquid diffuser, G. M. Smyth..... 190,789
Liquids, conveyance of, G. W. Remsen..... 190,902
Lock for satchels, etc., W. Roemer..... 190,907
Loom stop motion, F. Christen..... 190,741
Loom temple, C. H. Schlaf..... 190,783
Lounges, folding, H. S. Carter (r)..... 7,693
Lounges, machine, C. H. Hall..... 190,754
Lubricator for steam engines, W. Moses..... 190,722
Lubricator for journals, J. H. Burnett..... 190,692
Malt extract, separating, H. R. Randall..... 190,899
Malt extract, making, H. R. Randall..... 7,688
Marking ground, F. W. Byrne..... 190,819
Metallurgical hearth, removable, A. Ponsard..... 190,691
Moulding and casting pipe, J. K. Dimmick..... 190,833

DESIGNS PATENTED.

9,971.—SHADE RINGS.—L. J. Atwood, Waterbury, Conn.
9,972.—CASSIMERES.—G. C. Burns, Burrillville, R. I.
9,973, 9,974.—HANDLE EARS.—R. H. Burr, West Meriden, Conn.
9,975 to 9,987.—WALL PAPER.—C. Dresser, London, Eng.
9,988.—OVERSHOES.—A. S. Hubbard, New Haven, Conn.
9,989.—LAMP BRACKETS.—A. D. Judd, New Haven, Conn.
9,990.—CASSIMERES.—C. Kimball, Mohegan, R. I.
9,991.—GLASS JAR.—S. R. Pinekeny, New York city.

A copy of any one of the above patents may be had by remitting one dollar to MUNN & CO., 37 Park Row, New York city.]

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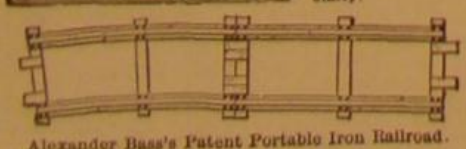
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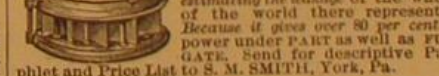
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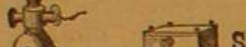
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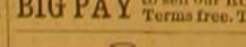
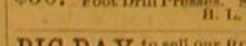
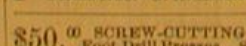
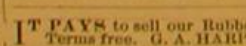
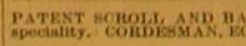
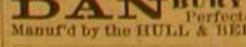
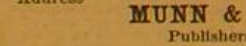
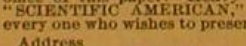
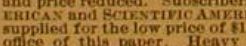
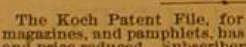
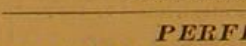
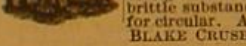
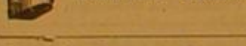
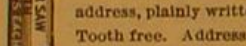
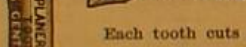
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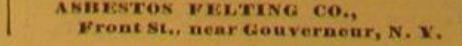
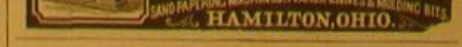
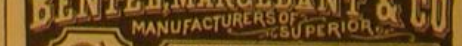
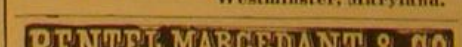
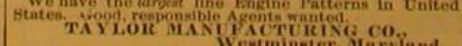
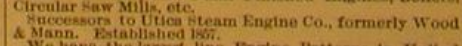
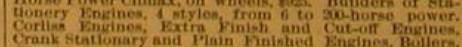
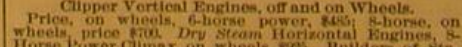
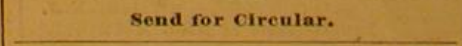
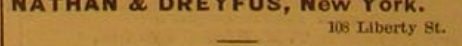
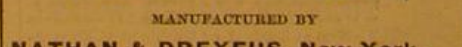
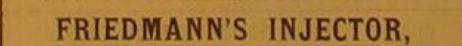
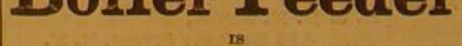
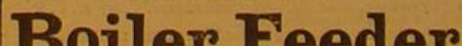
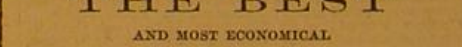
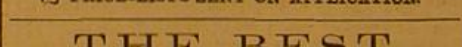
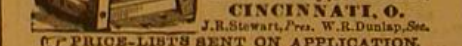
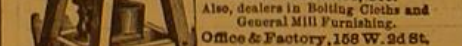
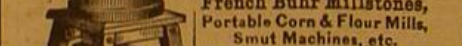
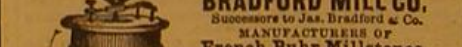
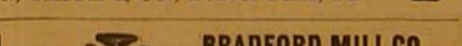
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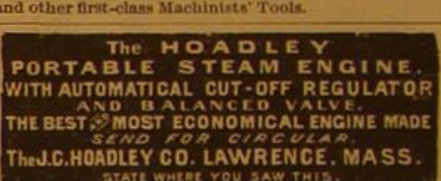
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SCIENTIFIC AMERICAN

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

Vol. XXXVI.—No. 26.
[NEW SERIES.]

NEW YORK, JUNE 30 1877.

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A STEAM NAVVY.

The handwork of the "navvy" or navigator has of late years been superseded in many ways; and the invention illustrated herewith will further economize manual labor, as it excavates its own pathway through hills, and fills wagons with the removed earth or stone. Lines of rails are arranged for the wagons so that there is always a train of empty wagons standing on a central road behind the navvy, whence they are drawn over a short jump road into position on the side roads for filling, while the filled wagons run back from the machine on the side roads. The navvy illustrated is capable of excavating and filling into wagons at the rate of 60 cubic yards per hour, two men and one boy being required to work it.

This machine is constructed mainly of wrought iron, so as to withstand the heavy work that it has to encounter. The mode of working it may be briefly described as follows: The engine driver, who has the control of all the moving parts, is directed by the man who has charge of the scoop, and who stands on the circular platform at foot of the jib in front of the machine. When the jib is swung to the position required, the scoop is lowered till the mouth of it rests upon the ground. The man on the circular platform, by means of a foot brake and gear, holds the scoop in that position, so fixing the length of the scoop handle from a pivot or point on the jib. The scoop is now drawn forward by means of a chain and winding drum, thereby cutting all before it, according to the radius described by the length of the scoop handle. As soon as the scoop is filled, the man who has charge of it eases the foot brake, allowing it to come out of its cut. When lifted high enough, the jib is then swung round until the scoop is brought over the wagon to be filled; the attendant now by means of a trigger line draws the spring catch bolt, allowing the hinged bottom to drop down, discharging its contents into the wagon. The jib is then swung round again, the scoop lowered, and the operation repeated.

After the machine has excavated all that is within its

reach, the anchor screws are slackened off, extra sleepers with a short length of rails are then laid down in front of it, and by means of the propelling gear it is moved forward the required distance. The anchor screws are then screwed down in order to prevent the machine from slipping back when at work.

We are indebted to *Engineering* for the engraving and description of this machine, which is the joint invention of Messrs. Dunbar and Ruston.

Detection of Adulteration in Butter.

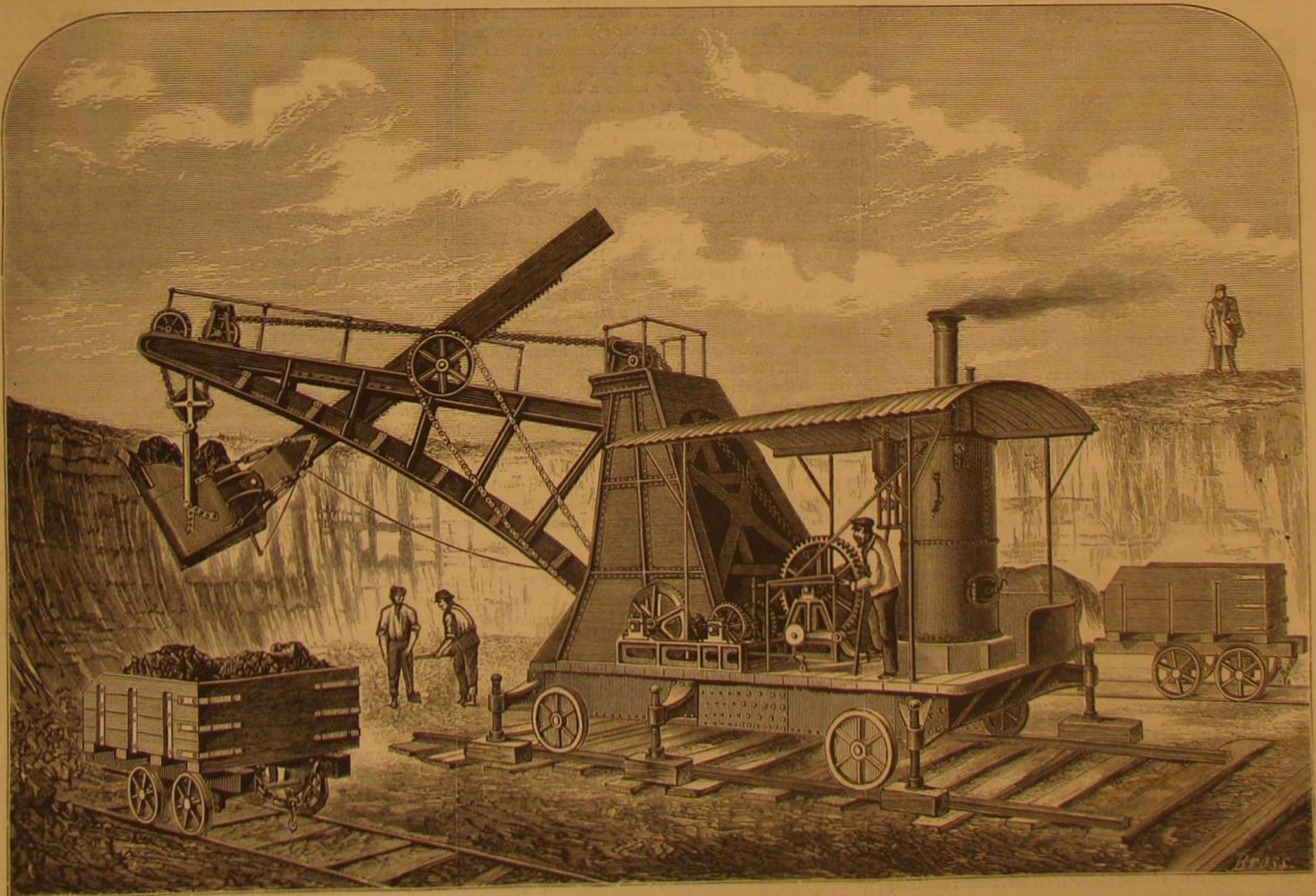
Artificial butter seems at present to be attracting even more attention in Europe than here. R. Godeffroy, of Vienna, after describing its manufacture, remarks that artificial butter has a pale yellow, perfectly homogeneous appearance, does not taste the least bit like tallow or otherwise disagreeably, and melts in the mouth just like real butter. It differs from the latter in lacking the flavor characteristic of the real butter, by its lower melting point, by its smaller percentage of water, and by having a smaller amount of caseous matter, insoluble in ether.

According to Boussingault, rightly made, well washed, and well dried artificial butter contains 13 to 14 per cent of water, while the ordinary market butter of Paris contains from 18 to 24 per cent of water. Moser found only 6.4 per cent of water in artificial butter; but in the market butter of Vienna he found from 14.9 to 20.1 per cent of water.

In pure butter Boussingault found 3.13 per cent of caseous matter, insoluble in ether, and in artificial butter only 1.2 per cent. Moser found that artificial butter melts at 28° C. (82° Fah.), while genuine butter melts at 33° to 36° C. (92° to 96° Fah.). He believed that the melting point furnished a quick and easy method of distinguishing the artificial from the genuine. For this purpose it does indeed offer a certain and not-to-be-despised means of distinction; but it fails to detect the mixture of the two. For the latter purpose, no certain and easy method has yet been found. Angell and Gatehouse have indeed described certain methods of doing

this; but they are in part roundabout and circumstantial, in part insufficient. O. Kunstmann recommends that the butter be drawn up by a piece of wick $\frac{1}{2}$ inch wide, and lighted; after burning 1 or 2 minutes, let the flame be blown out, and the odor of the smoke and vapor ascending from the wick noted. It is easy to tell by the odor whether the butter is pure or adulterated; but the odor of the vapor is less intense when the butter is adulterated with lard than when tallow has been employed as the adulterant. Dr. O. Bach gives a simple method of butter analysis based on some of the above properties. The only apparatus required are a thermometer and a test tube. In the latter is placed 3 volumes of ether and 1 volume alcohol of 95°. About 15 grains of butter are put into 20 times this quantity of the alcohol and ether mixture, and the test tube placed in water heated to 20° C. (68° Fah.). If the room is heated to this temperature, the warm water is of course unnecessary. At this temperature pure butter is completely dissolved; the salt remains and settles, and its quantity can be estimated from its bulk. The small amount of caseine which is present in pure butter is mostly attached to the sides of the tube; all else is in solution. Butter adulterated with lard, beef tallow, or mutton tallow leaves the latter undissolved at the above temperature; and if the quantity exceeds 10 per cent it is easily recognized. If the butter in question contains less of the foreign fats, it is only necessary to cool the test tube in a stream of water without permitting any water to enter the tube, when the liquid will become turbid from precipitation of the fat. A solution of pure butter can be cooled without getting cloudy. This method is so simple that persons who are not chemists may employ it.

ARTIFICIAL flowers called barometers are being now exhibited in a number of Parisian opticians' shops. They are colored with a material composed of chloride of cobalt. When exposed to sun and dry air the leaves become deep blue; when the air is saturated with moisture they become pinky. All the intermediate shades are easily observed.



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VOL. XXXVI, No. 26. [NEW SERIES.] Thirty-second Year.

NEW YORK, SATURDAY, JUNE 30, 1877.

Contents.

(Illustrated articles are marked with an asterisk.)

Answers to correspondents.....	419	New books and publications.....	429
Ballooning tube, ship's.....	426	Nickel plating.....	428
Banlan tree, the.....	431	Paper pulp engine.....	438
Beer, testing, for starch sugar.....	432	Para-Arabin.....	438
Bleaching wool.....	438	Patent decisions, recent.....	439
Business and personal.....	439	Patents, American and foreign.....	439
Butter, adulteration.....	439	Patents, official list of.....	439
Chuck, self-ejecting.....	439	Platinum, coating metals with.....	439
Clocks, mysterious.....	439	Projectiles, a new.....	439
Dyeing cloth black.....	439	Railway trains, fast.....	439
Dyeing loose cotton.....	439	Resin, a new.....	439
Eggs, desiccated.....	439	Science in war.....	439
Electricity in dyeing.....	439	Scientific American unrivalled.....	439
Electro-static induction.....	439	Snakes catch fish, do.....	439
Elevator, pneumatic.....	439	Steam economy again.....	439
Exposition, the, and workmen.....	439	Steam navy, a.....	439
Fireproofing hair rope (1).....	439	Steel armor plates, etc., making.....	439
Flowers, artificial.....	439	Steeling copper plates.....	439
Gauge, improved.....	439	Tartaric acid solution, preserving.....	439
Glycerin.....	439	Tern, the.....	439
Gold and silver in Russia.....	439	Tigress, an unmotherly.....	439
Gun, casting a large.....	439	Torpedo balloons.....	439
Honey in a chestnut tree.....	439	Torpedoes, making.....	439
Iron industry in Greece.....	439	Trance.....	439
Kauri gum.....	439	Tunnel, the Sutoro.....	439
Lecture experiment, new.....	439	Tunnel under the Pyrenees.....	439
Map, a remarkable.....	439	Turkey in America.....	439
Marmoset, an interesting.....	439	Vision, the limits and powers of.....	439
Metals, strength of.....	439	Waterpipes, London.....	439
Midian, the land of.....	439	Wine in France, yield of.....	439
		Writing, method of secret.....	439

TABLE OF CONTENTS OF THE SCIENTIFIC AMERICAN SUPPLEMENT, No. 78,

For the Week ending June 30, 1877.

- I. ENGINEERING AND MECHANICS.—Jackson's Ships' Lines, by EDWARD JACKSON: A description of improved ships' lines, combining easy entry with fine run. 3 illustrations.—New Channel Steamer.—Steel Wire Hawser.—Robertson's Improved Steam Engine, 2 engravings.—Underground Pumping Engine.—Improved Machine for Squeezing Puddles' Balls, by EDMUND SUCKOW; 3 figures.—Barker's Improved Hydraulic Brake, Midland Railway, England, 21 figures.—New Brickmaking Machine, 1 engraving.—Improved Carding Engine, 1 illustration.—Dynamometer for Measuring Strength of Fabrics, 1 illustration.—Steam Tree-Saw, 1 illustration.—40-Ton Gun. New Trials, 2 figures.—Torpedoes.
- Drainage of the Zuyder Zee.—Military Obstructions of Channels.—Destruction of Turkish Ironclad.
- II. TECHNOLOGY AND MANUFACTURES.—Washing and Water-beating Fabrics.
- The California Soap Mine.—Depositing of Cobalt upon Metals.
- III. ELECTRICITY, LIGHT, HEAT, ETC.—New Electro-Magnetic Engines, by MARVIN EGER; 4 figures.—Electric Candle.—Heat: Abstract of a lecture, by Professor TYNDALL.
- IV. ASTRONOMY.—A Home-Made Equatorial Telescope Stand, by T. D. SIMONSON; 4 figures. With full instructions for making.
- V. PHYSIOLOGY, ETC.—Poisonous Effects usually attributed to Salts of Copper.—Zinc a Normal Constituent of the Human Body.—Animal Heat.—Physiological Action of Glycerin.
- VI. LESSONS IN MECHANICAL DRAWING, by Professor C. W. MACCORD. Second Series, No. X. Explaining the Principles involved in Drawing Screw Propellers. With illustrations.
- VII. MISCELLANEOUS.—General Index of SCIENTIFIC AMERICAN SUPPLEMENT, vol. 2, being from January 1 to June 30, 1875.

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THE LIMITS AND POWERS OF VISION.

Delicacy of vision is due to two causes: sensitiveness of the retina, which allows of the perception of minute differences of light, or, in other words, of the clear definition of objects illuminated very slightly more or less than the background against which they appear; and the perfection of the different portions of the eye itself, which admits of the perception of very small objects, or of separating those nearly approximated without the images becoming confused through irradiation. Dr. Carpenter states that the smallest particle of a white substance distinguishable by the naked eye upon a black ground, or of a black substance upon a white ground, is about $\frac{1}{16}$ inch square. "It is possible by the closest attention," he continues, "and by the most favorable direction of light, to recognize particles that are only $\frac{1}{16}$ inch square, but without sharpness and certainty. But particles which strongly reflect light may be distinctly seen when not half the size of the least of the foregoing. Thus, gold dust of the fineness of $\frac{1}{16}$ inch may be discerned with the naked eye in common daylight. When particles that cannot be distinguished by themselves with the naked eye are placed in a row, they become visible, and hence the delicacy of vision is greater for lines than for single particles. Thus, opaque threads of more than $\frac{1}{16}$ inch across, or about half the diameter of the silkworm's fiber, may be discerned by the naked eye when they are held towards the light."

Professor Mayer, in the first of his admirable papers on the "Minute Measurements of Modern Science," now appearing in the SCIENTIFIC AMERICAN SUPPLEMENT, states that by actual experiment he has determined the limit of visibility of the minute to be exemplified by a disk $\frac{1}{16}$ inch in diameter and a line about $\frac{1}{16}$ inch in breadth. The same authority has found from several measures that a line $\frac{1}{16}$ inch in breadth is obtained by drawing the finest line possible on Bristol board with a sharply pointed H H pencil.

In general, in order to distinguish clearly a dark object on a light ground, or the reverse, it is necessary that the object subtend an angle of at least one minute. But this again is dependent upon accidental and often personal conditions. Gassendi, the astronomer, was unable to perceive with the naked eye (protected only by smoked glass) solar spots subtending angles of 80 seconds; while other astronomers have, by practice, acquired the power of distinguishing spots of 50 seconds in diameter.

On a clear moonless night, every one possessing average powers of sight is capable of discerning stars of the sixth magnitude. There are, therefore, at any time two thousand stars visible above the horizon, or about four thousand over the entire heavens. But under very favorable circumstances and in the absence of all other light (reflection of terrestrial lights, zodiacal light, twilight, etc.), when the atmosphere, cleansed by recent rain, is very moist and the stars seem exceptionally brilliant, heavenly bodies between the sixth and seventh magnitude are also discernible by the naked eye. The contrast due to the apparent extinction and apparition of the smallest stars, a phenomenon due to their twinkling, allows of their being momentarily perceived, especially by the parts of the retina a little to one side of the direct point of formation of the image, as these parts are usually more sensitive on account of their not being normally used for visual purposes. Under these conditions, persons whose sight has become acute through repeated observations are able to see, in the entire heavens, some eleven thousand stars, this aggregate having been determined by the astronomers Heis, at Munster, and Gould, at Cordova.

It is ordinarily possible to see six stars in the Pleiades; some people can distinguish seven. Heis has counted ten, Denning at Bristol saw thirteen, and Moestlin, Kepler's preceptor, saw fourteen. Mr. Heis possesses both the qualities of delicate vision above noted in a remarkable degree. In full sunlight he has perceived Venus, Jupiter, and Mercury; and at night, when the moon was absent, he saw Vesta and Uranus, with the unassisted eye. So clear is his sight that he is at all times able to separate the two neighboring stars of γ of the Great Bear, and also those relatively distant δ 30" known as α in Capricornus. When the sky is very clear, he has resolved ϵ of the Scorpion, δ of the Lyre, and ϵ of the same constellation, of which the stars are distant but 3' 27".

There are, however, well known cases of even more wonderful feats of vision. The difficulty of perceiving the satellites of Jupiter is enormous because of the great brilliancy of the planet and the nearness of the satellites. The first of the latter is distant but two and a quarter minutes, and the fourth nine minutes and three quarters. They vary in brilliancy from seventh magnitude downward, so that in any event they are radically invisible to the average naked eye. The third satellite is the largest and brightest, and hence this one is most frequently seen, although Heis, with all his wonderful powers, has never accomplished its perception. Jacob, however, saw it at Madras, and Buffham and Mason in England. Boyd saw both the second and third satellites separate and distinct in 1860, and Denning perceived the third and fourth, in 1874, by masking the bright face of the planet. Schoen, a tailor of Breslau, perceived the first and third satellites at the time of their greatest elongation. These are the most difficult to separate, owing to their proximity to Jupiter.

Probably the most difficult feat of all recorded done by human sight is the perceiving of the crescent of Venus. This has been done but three times, once by Stoddard, a missionary on the high table lands of Persia, once by Theodore

Parker when a child in Chili, and once by Abbé André, in 1868, in France. The Abbé saw the crescent when it subtended an angle of but fifty seconds.

TRANCE.

Whether his particular theories and opinions do or do not hold strictly correct when gauged by more extended future investigation, Dr. George M. Beard, of this city, is doing capital work in directing the light of purely scientific inquiry upon that host of psychological delusions, which occupy a vaguely defined supposititious borderland of science. It is hard nowadays for any thinking person to view with equanimity the miserable deceptions which are imposed, not upon the obviously ignorant, but apparently upon the most enlightened portion of the community. College professors, to whom we look for the careful training of young minds, have lent themselves to the serious consideration of the absurd performances of a self-styled mind reader. A person of morbid intellect was recently enabled in this city to inflict a room full of sensible people with a lecture replete with the profoundest nonsense, through the wholesale publication of an invitation apparently signed by some of our foremost citizens. Blue glass panes, dotting the windows of scores of the finest mansions, attest the fact that a popular delusion is by no means confined to the presumably educated. "The outcome of two thousand years of human learning since the foundation of the science of logic by Aristotle," says Dr. Beard, "is that the *Encyclopædia Britannica*, in its latest edition, regards it as an open question whether ghosts appear." In short, even if the majority of people do not absolutely acquiesce in a modern form of superstition or delusion, they declare with Emerson that all these claims are mysteries of which a wise man would prefer to be ignorant. Credulity, then, on one hand, ignorance on the other, whether self-imposed or not: these are the mental states, which generate a third, wherein a reasoning being bids farewell to his reason, wherein a logical mind becomes illogical, and doubt, surmise, and deception reign unchecked.

Dr. Beard has made an especial study of the symptoms connected with the nervous system, whereon are based the superstitions known as mesmerism, animal magnetism, hypnotism, etc. As the result of his investigations, he propounds the theory that "trance is a functional disease of the nervous system, in which the cerebral activity is concentrated in some limited region of the brain, with suspension of the activity of the rest of the brain and consequent loss of volition." From this hypothesis, he deduces explanations of all the various phenomena which have been ascribed to the causes above detailed. For the sake of convenience, trance is divided into four varieties: the spontaneous, the self-induced, the emotional, and the intellectual trance. A typical form of the first is natural somnambulism or sleep-walking, in which, "the cerebral equilibrium being spontaneously disturbed through the subjective action of dreams, the subject, under the dominion of a restricted region of the brain, the activity of the rest of the brain being suspended, runs and walks about like an automaton. Under self-induced trance are comprised those cases where the subject can bring himself into this state at will, either suddenly or gradually. This can be accomplished by low living, approaching nearly to starvation. Emotional trance, which includes by far the larger number of cases, may be induced by fear, reverence, wonder, or expectation, exerted to such a degree that the activity of the brain is suspended, while these emotions are abnormally active, and consequently the will loses control and the subject acts automatically in response to external or internal suggestion, doing the very things he wishes to avoid doing, and being unable to do what he desires. It is of no consequence in what manner this trance is produced; it is purely subjective, and depends wholly upon the emotions of the subject. The mesmeric operator or medium has really nothing to do with the physical effect produced; it is only necessary that the subject believe in him. To intellectual trance belong the extreme cases of absent-mindedness. A large portion of the brain is active, and, until aroused, is insensible to surroundings and responds automatically to external suggestions or influences.

We cannot here follow Dr. Beard in detail through all the phenomena of trance to which he shows that his theory can be fitted. Some of his explanations are exceedingly ingenious, and merit study; and the simple simile, which he offers to realize his distinction between sleep, trance, death, and normal waking state, is quite happy. "When all the burners of a chandelier are fully lighted," he says, "that is the normal waking state; when all of the burners are turned down low but not turned out entirely, that is ordinary sleep; if I turn out entirely all the burners except one, and that one, as often happens, flames all the more brightly from increased pressure, that is trance; if all the burners are turned out entirely and permanently, that is death."

The application of the hypothesis to the singular phenomenon of double life—cases of which we have repeatedly noted—is perhaps the most interesting. In trance there is probably always consciousness at the time; but it is not always or usually remembered consciousness. On awaking, the dreams fade; but on resuming the trance state, the exalted functional activity of the region of the brain in which the cerebral force is concentrated is able to bring back these impressions of the previous attack of trance, forgotten during the intervening normal state. Thus the subject carries on an independent trance life. On returning to the normal state, the cerebral force, being again diffused, is insufficient to enable the subject to recall trance experience, but quite

sufficient to enable him to recollect his normal feelings. Thus he leads two independent lives.

The direct consequence of Dr. Beard's theory is that it tends to reduce all such delusions as clairvoyance, spiritualism, etc., to one common basis of scientific hypothesis; but the indirect consequence seems to us to be fraught with much graver interest to society. The only deduction to be drawn is that there is more evidence of the irresponsibility of humanity, further proof of another state when man may be but an automaton. Last week we brought forward competent medical evidence to prove that a drunken man is as irresponsible as a lunatic. Here again is expert testimony to the effect that, under a host of other conditions, a person may become unaware of his own acts. If fear and excitement are powerful exciting causes for trance, and the person in the trance or near the trance state receives erroneous impressions, wherein is the value of evidences by eye-witnesses of crimes committed under circumstances of great fear or excitement? Testimony as to sudden accidents might be similarly viewed with doubt; yet on the other hand, if we admit irresponsibility in the entranced person, how are we to guard ourselves against deception? for, as Dr. Beard says, "nothing is easier to counterfeit, after slight practice, than the early physical symptoms of trance." We cannot but agree with our author in the view that the day for the examination of this subject by the average individual has gone by, and that the only reliable informant is the medical expert. We do not send committees of lawyers and clergymen to examine peculiarities in construction of buildings; how much less logical is it to ask them to comprehend the hidden phenomena of brain construction? We need something more than a report of what trustworthy men think they see; and that something is the testimony of experts who look to causes and not to mere visible effects.

THE BANIAN TREE.

Of the remarkable phases of vegetable growth, that of the banian tree is certainly the most astonishing. We have more than one running plant, which, like the wild strawberry, spreads around a central stem by dipping into earth its distant branches, and thus establishing subsidiary centers; and in the mangrove of our southern shores we may see a tree, of considerable height, dropping from elevated limbs a number of whip-like roots which penetrate the ground, often through a foot or more of water; then, reversing their circulation, they become true stems, capable of maintaining themselves when separated from the parent stock. But, even with these illustrations before us, it is hard to realize the appearance and life conditions of a wide-spreading communal forest, the connected outgrowth of a single tree.

The anomalous physiology of a mangrove or banian root stem we have never seen described. How is it that its character is so completely reversed? At first its growth is downward, by a true root-like increase of cell structure at its free end. It remains perfectly cylindrical throughout, without the slightest variation in diameter, until it branches in the ground. Up to this point its circulation is downward from the parent stem; but now all is changed. It ceases to be a root, and becomes a stem, growing and supplying its branches with sap like a tree trunk of ordinary growth.

The banian adds another strange peculiarity, namely, that it rarely sprouts from the ground, the crown of a palm being usually its starting place. The banian seed is dropped by some bird into the frond, or upper cluster of leaves of the palm, and, sprouting there takes root within the palm: this commonly when the palm is in its infancy. The palm grows upward, an unbranching column. The banian spreads outward and begins to send its root stalks downward from its branches; not diverted twigs, but special growths, true aerial roots. With this exception, Milton only describes without exaggeration, when he writes of this tree as

"Branchings so broad along that in the ground
The bending twigs take root, and daughters grow
About the mother tree, a pillared shade
High over-arched, with echoing walks between."

Meantime the palm is pushing upward, embraced by the descending banian shoots, which become so interlaced in course of time that the trunk of the palm is wholly concealed. At this stage appearance flatly contradicts reality; the palm seems to be growing from the heart of the banian, as though a date seed had taken root in the banian top. Possibly the curious Hindoo custom of marrying trees of different species had its origin in, or was suggested by, these natural unions.

The banian (*Ficus Indica*) is one of the great natural family the *Artocaryaceae*, to which our familiar stinging nettle also belongs. It bears a small red fig or berry, which in times of famine has afforded food for thousands. An instance of the vast extent of country which may be covered by a single-tree banian grove is furnished by the island of Nerbudda, which is entirely covered by one tree. A considerable portion of the island and the grove growing upon it has been washed away by river floods during recent years; but enough remains to make one of the noblest groves in the world. The natives boast that it once afforded shelter for a troop of 10,000 horse. Another extensive banian forest—all parts of one tree—occurs in the district of Beerbhoom, in Bengal. It covers "an immense extent of country," and overshadows more than four hundred temples.

The bride of the banian, in the ceremony above alluded to, usually the sacred *peepul*, or *bo-tree* (*Ficus religiosa*). It is one of the latter that inspires such widespread reverence among Thibetian and other Buddhists, from the circumstance

that its leaves bear well marked characters in their sacred language. That these characters are not the work of the priests who have charge of the tree seems to be well established. A couple of French missionaries who were permitted to examine the tree report their inability to discover the least sign of art in these mysterious—and to the Buddhists miraculous—markings. "We examined," they write, "everything with the closest attention, in order to detect some trace of trickery, but we could discern nothing of the sort; and the perspiration absolutely trickled down our faces under the influence of the sensations which this most amazing spectacle created."

The mental attitude of these perspiring missionaries, when brought face to face with an alleged miracle that bore no evidence of trickery, is instructive. That the markings could be natural seems not to have occurred to them. Dr. Hooker, from his familiarity with Nature in India, was able to explain the miracle offhand with the single word "insects!"

VOLPICELLI'S NEW THEORY OF ELECTRO-STATIC INDUCTION.

An insulated conductor charged with either kind of electricity acts on bodies in a natural state placed near it in a manner analogous to that of the action of a magnet on soft iron, that is, it decomposes the neutral fluid, attracting the opposite and repelling the like kind of electricity. The action thus exerted is said to take place by influence or induction. The usual apparatus for demonstrating this hypothesis is a brass cylinder placed on an insulated support and provided at its extremities, or at various points along its length, with pith balls suspended by linen threads. If this arrangement be placed near an insulated conductor charged with either kind of electricity, the natural fluid of the cylinder is supposed to be decomposed, and free electricity is developed at each end, when both pith balls there located will diverge. The electricity of opposite character to that of the conductor goes to the end of the cylinder nearest that conductor, while electricity of the same kind as the conductor seeks the further extremity. There is a point on the cylinder where no divergence of the pith balls occurs, and this is termed the neutral point.

This hypothesis was, some thirty years ago, attacked by Melloni, who asserted that the imaginary electric fluid was not separated into its positive and negative components, but that both of the latter existed all over the cylinder, although, in point of quantity, there was more negative fluid on the end nearest the positive conductor and more positive fluid on the opposite extremity. The difference between Melloni's theory and that first noted will be clear from the annexed engravings. If the inducing source, *c*, Fig. 1, is positively electri-

Fig. 1.

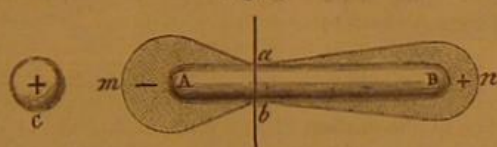
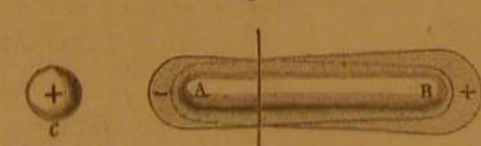


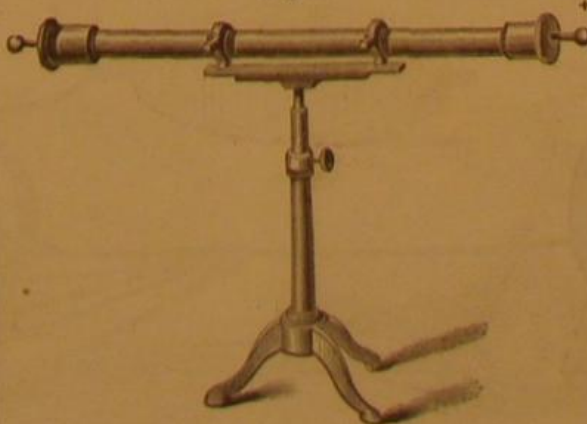
Fig. 2.



he died; but his work was taken up by M. Volpicelli, who for some twenty years has pursued the necessary investigations, and has recently announced conclusions confirming those of their original enunciator.

M. Volpicelli's apparatus consists of a large glass tube, 70 inches long, terminated by metallic armatures, and contain-

Fig. 3.



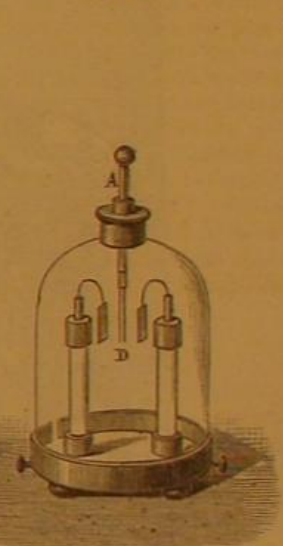
ing a dry pile composed of 24,000 disks closely packed together and covered with a layer of copper on one face and of peroxide of manganese on the other (Fig. 3). This bat-

tery works uniformly for several months, and is a constant source of electricity. The body on which the induced electricity is developed is an ordinary glass cylinder, perfectly isolated by threads of raw silk, by which it is suspended in the crotches of a support (Fig. 4). The electricity rendered free by induction is taken on the cylinder by means of a little proof plane, which merits a special description; for the success of the experiments is largely dependent upon the excellence of the instruments used and the care with which all possible causes of error are avoided. The plane is composed of two small disks of copper, 0.35 inch in diameter, separated by a thin layer of insulating varnish. One of these disks is in communication with the soil by means of a metallic rod which is held in the hand. The other disk is fixed to a metallic rod terminating in an ivory ball, which slides freely in an opening situated in the middle of the first disk and in an eyelet carried by an annexed arm. In order to use the device, the two disks are brought into contact, and the movable disk is placed on the cylinder. The free electricity on the surface of the latter condenses on the disk, and may be transported to a distance, as, for example, upon the exterior armature of an electroscope, situated far enough away from the dry pile not to be influenced by it. M. Volpicelli also uses a proof plane consisting simply of a pin head. A portion of the end of the pin is cut off, and the rest inserted in a knob of sealing wax at the end of a metal handle. A Böhnenberger electroscope, containing improvements devised by M. Volpicelli, is also used. The two plates, towards which the gold leaves, *D*, are attracted when the exterior armature, *A*, is electrified, are supported by two glass columns containing dry piles analogous to those of the large inducing cylinder (Fig. 5). This electroscope has

Fig. 4.



Fig. 5.



great sensibility. It might be termed a kind of electrical microscope.

In order to make the experiments, the insulated cylinder is properly placed in view by the electric source. It becomes electrified by induction. The free electricity on the cylinder is collected by the proof plane; and with the charge plane the electroscope is touched. The following phenomena then appear:

1. The free electricity found on the portion of the cylinder nearest the electric source is of the same character as that of the latter. This is diametrically opposite, of course, to the assertion of the old theory. The experiment may be repeated five or six times successively.
2. If the cylinder be placed in communication with the soil, so that the free electricity is allowed to escape, and the experiment with the proof plane be again tried, no sign of electricity is manifest.
3. If the cylinder be moved away from the electric source, so that the influence of the latter is diminished, and the proof plane be applied, the electroscope to which the latter is touched indicates an electricity of opposite character to that of the inducing body.

M. Volpicelli sums up the result of his investigations as follows: "Upon an insulated conductor submitted to the influence of an electrified body, electricity of opposite name possesses no potential. It is found in greatest quantity at the end of the conductor nearest the electrified body, and diminishes towards the opposite end. Electricity of the same name as that of the electrified body is found at all points on the insulated conductor, the end nearest the electrified source not excepted. It increases as it approaches the other extremity, and is always free." We extract our engravings from *La Nature*.

A New Projectile.

Mr. W. H. Lewis, a Welsh gentleman, of Hafod, near Swansea, has invented a new engine of warfare, which will be likely to attract considerable attention. It consists of a cannon, so arranged as to discharge a sharp sword-blade crosswise in the direction of the enemy, the knife or cutter being so poised in its career through the air as to cover the whole space in a longitudinal direction described by the blade itself. An 8-inch ball would carry a sword 14 feet in length 600 yards, literally mowing down every human obstacle in its path.

MANUFACTURE OF THE HARVEY TORPEDO.

The Royal Arsenal at Woolwich, England, in which ten thousand hands are employed by Her Majesty's Government to fabricate the artillery and ammunition for land and sea service, has lately been producing different kinds of torpedoes, among them the Harvey torpedo, the manufacture of which is shown in a series of engravings presented this week, which we select from the *Illustrated London News*. It might be used with good effect, during the chase of one vessel by another of superior force, to give the former a chance of destroying its pursuer. The torpedo is encased in a wooden chest, which is buoyant, and can be set afloat by lowering it from the ship's deck with a windlass; after which, by the aid of a rope and one or two cork buoys, if required, it can be placed so as to drift or keep in the position for coming into contact with the enemy's ship. There is a lever projecting from the top of the chest at one end, which will descend immediately on being struck or pressed by the hull of the vessel to be destroyed; this lever sets in motion, at once, the mechanical apparatus attached to the percussion bolt, which is charged with detonating powder. The torpedo charge of gunpowder is thereby ignited, and it is highly probable that a large hole will be made in the ship's side or bottom, causing her to sink without any more trouble. Our illustrations show only the processes which may be witnessed by ordinary visitors to the Royal Arsenal. The interior construction of the torpedo, and the machinery connected with its percussion bolt, are not revealed to public inspection. Workmen are seen engaged in making the outer case and its fittings, the metal cylinder of the percussion bolt, and the cork buoys to serve in the practical application

of this maritime weapon. The last-mentioned operation is also illustrated by one of our engravings. The torpedo in question was invented by Commander Harvey, R.N.

Testing Beer for Starch Sugar.

It is sometimes desirable to ascertain whether to a given sample of beer there has been added, for the purpose of economizing the malt, a substance variously known as artificial grape sugar, starch sugar, or potato sugar, etc., which is made from potato starch. Some time since, Béchamp made the discovery that this starch sugar contained a peculiar substance, intermediate between real sugar and dextrin, to which he gave the name "amylin." Like real grape sugar, it turns the ray of polarized light to the right; but unlike it, it is incapable of fermentation.

Eugen Dietrich has recently made the discovery that amylin is a crystalloid, and therefore able to pass, when in solution, through a dialyser made of parchment. This furnishes a ready method of separating it from dextrin, which is a colloid and unable to pass through the dialyser. The method of analysis as applied to beer is as follows:

One liter ($\frac{1}{2}$ quart) of beer was subjected to dialysis for four days, water being frequently added. The dialysed liquid was evaporated to one quart, decolorized with animal charcoal, and filtered. Washed yeast was added to the filtrate, which was quietly left to itself at a temperature of 68° Fah., and in two days no further evolution of carbonic acid was perceptible. To make certain that all the sugar had been removed, fresh yeast was again added, left two days more, and the liquid filtered and polarized. According to Neubauer's experiments, commercial starch sugar contains

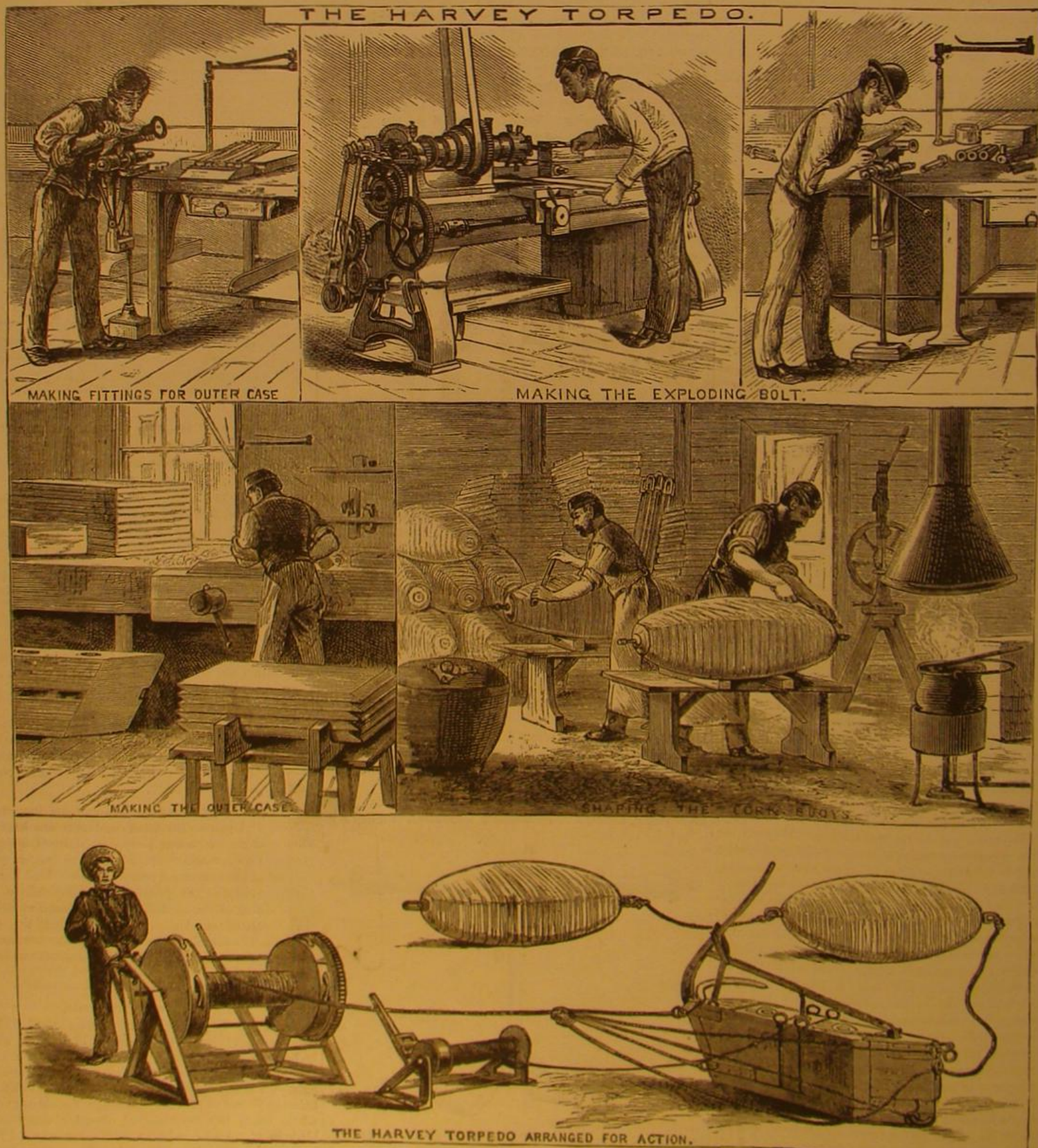
20 per cent of this non-fermentable substance. Hence we may conclude that the quantity of amylin found, when multiplied by 5, will give approximately the quantity of starch sugar employed. But 1 lb. of this sugar will replace on an average $2\frac{1}{2}$ lbs. of malt, thus indicating the amount of malt saved.

Dyeing Cloth Black.

We dissolve for 50 lbs. of cloth, 2 lbs. of bichromate of potash; $1\frac{1}{2}$ lbs. cream of tartar, and 3 lbs. of sulphuric acid in river water; we heat to a boil, and introduce the wool, which is let stop for one hour. The dye beck is composed of 35 lbs. of logwood, 2 lbs. of peach wood, 1 lb. of fustic; these woods are inclosed in sacks, and kept for 2 hours, before dyeing, in the necessary quantity of boiling water. The dye beck receives besides 2 lbs. of sulphate of indigo, and $1\frac{1}{2}$ lbs. of sulphuric acid. We put the wool in this beck, which is raised afterwards to a boil for $1\frac{1}{2}$ hours, washed and dried.—*Vict. Preston, in Dingler's Journal.*

Without a Rival.

"The SCIENTIFIC AMERICAN, published by MUNN & Co., New York city, is without a rival as a scientific paper, and to the mechanic is simply invaluable. We honestly believe any mechanic would derive information from a year's reading of the SCIENTIFIC AMERICAN which any amount of money could not buy elsewhere. Some of our enterprising citizen mechanics, we hope, will try the experiment of reading this really valuable and practical journal one year. We know," says the Glasgow (Ky.) *Weekly Times*, "they would never give it up."



TORPEDO MANUFACTURE AT WOOLWICH, ENGLAND.

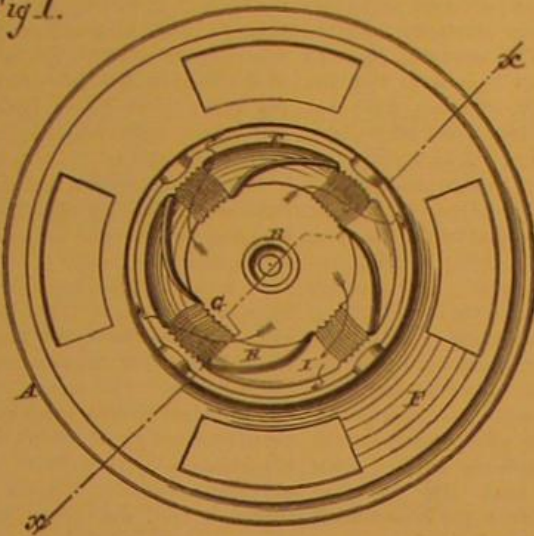
IMPROVED PAPER-PULP ENGINE.

The new feature in the engine illustrated herewith consists in the female cone, provided with groups of radial knives and guide cavities in the spaces between said groups of knives.

Upon the bottom of the case, A, is formed a hollow column, B, to receive and serve as a bearing for the vertical shaft, C, and which rises a little above the top of the case, A, to prevent the pulp from coming in contact with the shaft, C, and clogging and wearing it. To the shaft, C, above the top of the hollow column, B, is attached the hub of an inverted frustum of a cone, D. The lower part of the hub of the cone, D, is recessed to receive the upper end of the hollow column, B, so that the face of the male cone, D, may coincide with the face of the female cone, E.

To the face of the cone, D, are attached radial knives, not shown in the drawings. To the face of the cone, E, are attached knives, G, which are arranged in groups, and are made with an angle or curve, as shown in Fig. 1, to prevent them from interlocking with the knives of the cone, D. In the face of the cone, E, between the groups of knives, G, are formed two concavities, H I. The concavity, H, leads up from the lower edge of the cone, E, to the front of the group of knives, G, to serve as a spout to conduct the pulp to said knives; and the concavity, I, leads from the rear of the group of knives, G, to the upper edge of the cone, E, to serve as a spout to conduct the pulp from the knives to the upper edge of the cone, E, so that it may pass freely back into the case or tank, A. To the lower edge of the cone, E, is attached the upper edge of a tube, J, which extends down nearly to the bottom of the case, A. With this construction, the centrifugal force engendered by the revolution of the cone, D, causes the pulp to pass up between the cones, D E, flow over the upper edge of the cone, E, and flow back into the tank, A, the pulp from the lower part of the said tank passing into the tube, J, and up between the cones, D E, so as to establish a circulation, and insure all the pulp being properly acted upon. This invention was patented through the Scientific American Patent Agency, April 17, 1877, by Mr. J. S. Warren, of Cumberland Mills, Westbrook, Me.

Fig. 1.



apart a distance of about 10-5 feet, this being the height of three tiers of receptacles. Hence, after the cage has reached the summit, but three filled buckets or cars can be removed at a time, and three successive lowerings are necessary to bring the whole nine before the openings. The reception is accomplished as follows: The operator permits the cage to rise above the doors, and then closes the tube beneath them by a horizontal trap. The cage is thus prevented from falling, in case of any inopportune admission of air or accident to the machinery. Communication between the tube and the

be looked to: although this is naturally so delicate that it is perfectly easy to stop and hold the cage anywhere in the tube without having recourse to the wedges. When the three filled receptacles above noted are removed, the operator withdraws the wedges, and permits the cage to sink until the second and then the third tier of receptacles comes in place. Then the trap is opened, and the cage without its load, now weighing some 11,000 lbs., is allowed to sink to the bottom of the tube. Just before it reaches this point, the air escape is cut off, so that the piston cushions on the slightly

compressed air before it. The nine empty receptacles are then removed in the manner already described, three at a time.

M. Blanchet proposes soon to construct a second atmospheric tube, as shown in our illustration. The two cages will then travel in relatively opposite directions, and the work of the air pump will be diminished, the weight of one cage counterbalancing that of the other. The shaft is divided into two equal portions by a partition, one tube being in each compartment, while, in a third, an ordinary rope hoisting system may be arranged to serve as an auxiliary means of extraction. At D, in the illustration, is shown how the

WARREN'S PAPER-PULP ENGINE.

air pump is next closed, and a valve is opened, which allows air to enter very gradually above the cage. The latter then slowly descends. If the descent be too rapid, it is checked by closing the air valve or opening communication to the pump by means of a secondary small tube. By managing the two levers governing this apparatus, the cage is permitted to move down until tiers of buckets (Nos. 1, 4, and 7) are in front of the openings. Other levers are then manipulated, which cause wedges inside the tube to obstruct the further passage of the piston. In this way the cage is held motionless, so that no nice adjustment of difference of pressure need

various sections of the tubes are connected. It will be noticed that the weight of the several portions is not borne by the parts directly underneath, else the weight of the immense column might cause its deflection. Each section is supported by eight rods, which are secured to horizontal timbers imbedded in the rocky sides of the shaft. Within the tube also are four longitudinal guides attached to its inner surface, which serve to prevent the rotation of the cage, so that the ore or coal receptacles are always brought in proper position before the doors.

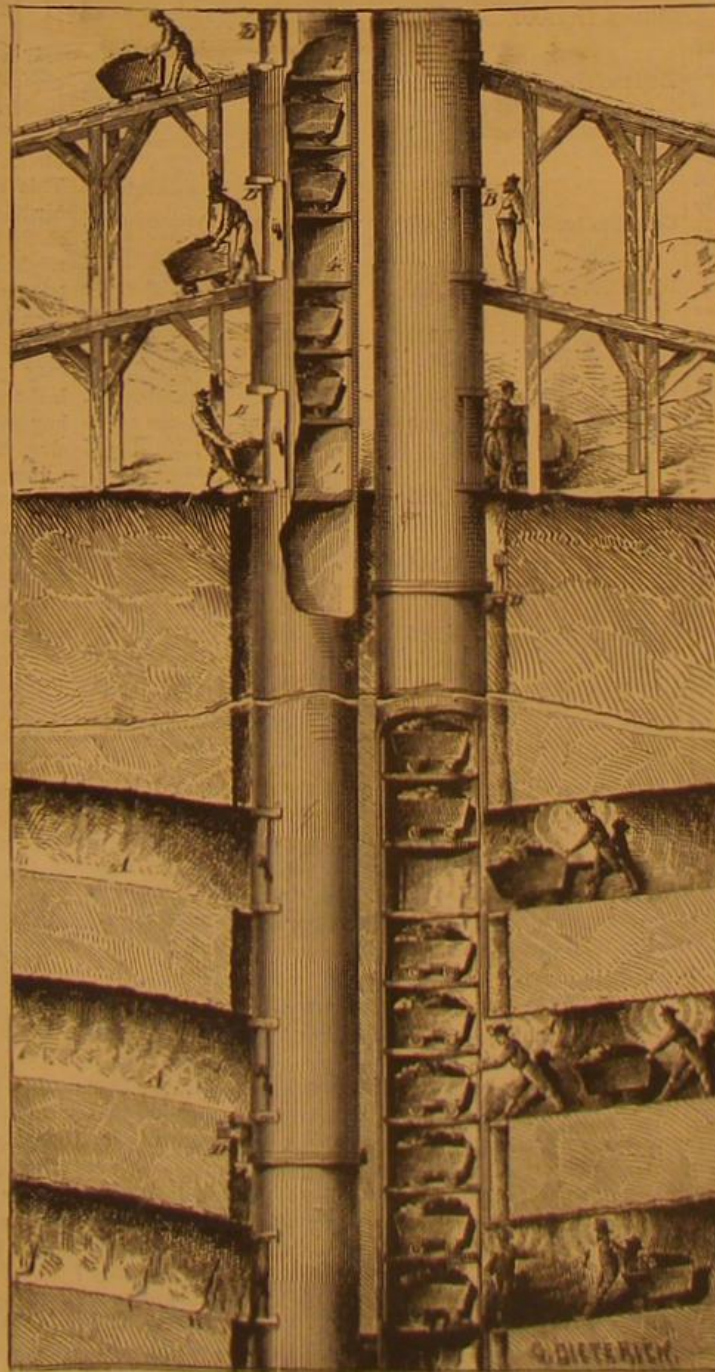
A New Resin—Kauri Gum.

We have recently met with a new vegetable product of peculiar origin and properties, the classification of which for some time was very puzzling until we made the acquaintance of a gentleman who was quite conversant with its appearance and sources. He at once pronounced it to be kauri gum, which is exported in some quantity from New Zealand. The physical properties of the gum were so different from those of most resins that we were led to try some experiments with it, which, though not entirely encouraging, may be here given to serve as a guide for those who choose to essay further trials of its usefulness from a photographic point of view. In appearance it is most like amber, which, also, in many other respects, it resembles. It is very similar to it in color, or one may say colors, for it is found in all the hues of amber, from the pale straw to light brown, and mingled also with cloudy-looking masses like clouded amber. It breaks with a lustrous fracture in the same manner as amber, but it is not so tough, and is consequently more fragile. Like amber, also, it is in a manner allied to fossil products; for, instead of being collected from growing trees, it is dug out of the ground on the site of old forests long laid low, and almost even with the ground—almost, but not quite, even; for to the little inequality on the surface of the broad, open ground, where the giant trees have fallen, does the gum hunter owe the power to find the hidden treasures of kauri gum. It is supposed that, possibly many centuries ago, conflagration of the tree scrub had destroyed the gum-bearing trees, which fell where they stood, half incrusting with the hardened sap, and according to their condition yielding small flakes or huge masses of sap, as the heated ground around them caused every particle of the resin to come to the surface. To find the gum, the heaps or mounds alluded to—which are covered with long grass and often scarcely discernible—are pierced by a steel-tipped spear which is carried for the purpose. A little practice soon enables the gum digger to discover if he has struck, not "ile," but gum. The experienced man then soon bares the spot, and finds pieces of the amber-looking material in blocks of various sizes, from a few ounces to half a hundredweight. This digging, which affords a means of livelihood to a large number of natives and colonists, known as "gum diggers," is also undertaken by the sheep breeder in his leisure moments, and to the small holder often, if luck favors him, forms a not unwelcome increase of income. It is collected and sent to market for shipment, and in England it appears to find purchasers who use it for the purpose of dressing calicoes with, for which object it is possibly dissolved by the aid of alkalis.

PNEUMATIC ELEVATION IN MINES.

M. Blanchet has recently constructed, at Epinac, France, an atmospheric elevator which appears to be an important improvement in means of lifting the products of mines to the surface. The shaft of the mine is lined with an iron tube of about 1,920 feet in length, through which a load of 23,000 lbs. can be lifted. A vacuum is produced above the piston which supports the cage, which is thus carried up the tube by the normal atmospheric pressure acting from below. After the load is removed, the piston is allowed to descend slowly by its own gravity, sufficient air being admitted above it. Compressed air is not used to force the piston upward, on account of the heat necessarily developed by its compression being objectionable; and further, because pressure from within the tube tends to open any little fissures which may exist, while on the other hand pressure from without (which obtains when there is a vacuum within) serves to close them.

The charge to be elevated by M. Blanchet's apparatus is, as above stated, 23,000 lbs., and the piston has a diameter of 5-1 feet. The weight is therefore about 7-2 lbs. per square inch, so that but a partial vacuum is required above the piston. A manometer placed on the upper part of the tube indicates the condition of affairs within the shaft very clearly. In case the piston, in rising, encounters inequalities in the tube, so that its movement is stopped or delayed, the air pump, continuing its work, increases the vacuum, and allows a greater degree of atmospheric pressure to be exerted to push the piston past the obstacle. This change in the interior atmosphere is of course instantly shown by the manometer needle. The annexed engraving clearly exhibits the arrangement. At A are the various headings and galleries, which meet the shaft, and from which the filled receptacles are placed in the cage. At B are the openings above for removing the load. The doors at these upper apertures are kept closed during the ascension of the cage, and are not opened until the latter reaches the end of its upward journey. It will be observed that the cage contains nine tiers of receptacles, while there are only three receiving apertures above. The latter are, however, spaced



BLANCHET'S PNEUMATIC ELEVATOR.

To return to the physical properties of the material. In its peculiarities of solution it acted more like copal; like that gum it is difficultly soluble, and further experiment may show still further likeness. One remarkable characteristic of copal is its power of becoming more soluble in alcohol after first melting it with as little heat as possible, when, upon resolidification, it is found much more easily soluble. We have not yet tried whether the kauri would act in a similar manner, but shall do so shortly. So far we have tried its solubility in alcohol, chloroform, benzole, and turpentine.

In alcohol it is quite insoluble after a week's digestion, a little coloring matter only being taken up. In chloroform it is soluble to a great extent—a small proportion, after repeated shakings during the course of a week's digestion, appearing to refuse to dissolve. In benzole it is partially soluble, though not nearly to the extent of the chloroform solution. In turpentine its solubility appears to lie between benzole and chloroform.

In all the three last cases a portion only of the gum dissolves, leading to the supposition that it may be composed of a series of different and distinct resins having preferential solubility in the various menstrua. Upon trying the varnishes thus produced upon negatives they all gave a beautiful glossy film, not easily scratched through so as to reach the glass, but very easily rubbed upon the surface, as though something of the nature of beeswax might be contained in the substance dissolved. The varnish with turpentine had a decided advantage over the others in tenacity.

Up to this point they are all, therefore, decidedly inferior to shellac as a photographic protective varnish; but further experiments are well worth trying, seeing this new substance can be bought at under one shilling a pound, while good shellac costs about three times the price. It is possible that treatment with an alkali may take from the kauri gum that principle which causes the surface gloss of the varnish to be so destructible. We may conclude our notice of this very interesting product by stating that all three of the varnishes give most excellent surfaces for retouching upon with black lead; indeed, we have met with no varnish superior to them for the purpose.—*British Journal of Photography*.

Communications.

Steam Economy Again.

To the Editor of the Scientific American:

Your correspondent, S. W. Robinson, in your issue of June 16, seems not to understand my language, in your issue of May 26, in regard to the loss due the clearance of an engine. In the process of calculation there referred to, and in all other processes in which the diagram is charged with the consumption indicated by its terminal pressure, and credited with the work performed as shown by its mean effective pressure, the loss occasioned by clearance through increased terminal pressure for a given load, or diminished mean effective pressure for a given consumption, is fully recognized, as the factors used in the calculation are the ones affected by clearance. It was the loss which is occasioned by "the expansion of the steam in the clearance space," when the exhaust or terminal pressure is greater than the return or counter pressure, which was referred to as restored when the compression pressure reached that of the exhaust.

I was not attempting to give the conditions necessary "for securing the highest percentage of useful effect from the steam used," but merely discussing a method of calculating the theoretical rate of water consumption indicated by any actual diagram, whether favorably or unfavorably conditioned. Hence there is no conflict between my statements and those of Rankine, either as given in his work or as ably illustrated by your correspondent; we are simply not talking about the same thing, as I am sure he will see if he gives my article a careful re-perusal.

Salem, Ohio.

J. W. THOMPSON.

Casting of a Large Gun.

The heaviest gun ever cast in this country, with perhaps two exceptions, was successfully produced at the South Boston Iron Company's works, near the Broadway bridge, South Boston, May 30, in the presence of about 150 persons, several of whom were ladies. Colonel Crispin, Colonel Bayler, Captain Phipps, Captain Bryant, Lieutenant Smith, and Lieutenant Whipple, of the Ordnance Corps; Colonel Randall, Major Sanger, Captain White, Captain Andrews, Lieutenant Nichols, and Lieutenant Patterson of the First Artillery, were present. The material used was the ordinary charcoal iron. The gun, which will be a 12-inch rifled Rodman, carrying a 700 pound conical ball, when finished is expected to measure 263 inches, or about 22 feet in length. The diameter at the widest part will be 55 inches, and the casing will be 30 inches for a depth of 232 inches. At the muzzle the outside diameter will be about 29 inches. The weight when finished will be 89,530 lbs., and when cast was about 162,000 lbs. There was 90 tons of metal in the three furnaces. The gun is expected to be completed in November. It is estimated that the mass will cool in about 150 hours.

Three large furnaces were used for the melting. The flask, which was some 29 feet long, was sunk all but about six feet into the ground, muzzle up. From the furnaces were runners, a sort of iron trough or spout, lined with clay, about 8 inches wide at the top, 4 inches at the bottom, and 6 inches deep, and each about 18 or 20 feet long. These led

to a sort of central tank or pool within 6 or 8 feet of the point where the flask or mould was placed. In this was an opening which led into two runners like those coming from the furnaces, and the runners carried the material from the pool to the mould. The pool was for the purpose of equalizing the consistency of the iron before it entered into the composition of the gun. At about 4:50 the visitors were requested to preserve quiet; the word was given, and the deep red stream of molten iron was soon seen rolling through the runners, with the accompaniment of great quantities of beautiful golden stars scintillating over the fiery mass. From the pool the liquid, after being thoroughly amalgamated, passed through the shorter runners and dropped to the bottom of the mould, the material rising gradually until the level of the troughs was reached. This occupied about 15 minutes, and then it became necessary to pour in from the top, which was several feet above the troughs. This was done by filling ladles (great tubs of iron lined with clay), each holding several tons of melted iron, and swinging them by three enormous derricks around to a runner raised higher than the others, and which led to the top of the mould. The portion filled up with ladles was in addition to the length of the gun, which must be cut off some six feet. This is necessary in order to have the end perfectly solid. The gun was cast upon the Rodman principle of having the core, which is hollow, filled with water during the process of casting by means of a pipe to convey cold water to the bottom of the core, and another to carry off the water from the top when it becomes heated. This causes the cooling inside and outside to be much more uniform, and adds greatly to the strength of the gun. The casting was finally finished about 5:30 o'clock, without accident of any kind. The gun when finished will be forwarded to Sandy Hook for experiments by the United States authorities.—*Boston Journal*.

Strength of Metals.

Some experiments have recently been made, in the mechanical technical laboratory of the Royal Polytechnical School at Munich, upon the strength of different alloys made by L. A. Riedinger at Augsburg. The results may be tabulated as follows:

Alloy.	Strength in lbs. per square inch.	Contraction of section, per cent.	Stretching of 1 1/4 inch, per cent.	Appearance of the fracture.
Phosphorus bronze.	27,122	2.4	2.25	Fracture blue-gray, darker than in bell-metal; contained an air-bubble of 1/8 inch in diameter.
Ditto	28,400	3.7	2.50	Fracture as before, with many little bubbles.
Bell metal	24,424	1.4	1.50	Fracture uniform, bluish gray.
Ditto	23,288	0	1.00	Fracture rougher than before; color somewhat lighter.
Common brass	20,448	14.2	4.50	Fracture dirty, yellow, dense, and quite fine.
Ditto	11,158	13.5	5.25	Fracture as before.
Fine brass	22,720	35.2	23.75	Fracture golden yellow, uniform, somewhat rougher than the other.
Ditto	20,306	34.5	15.25	Fracture as before, with orange yellow spots.
Common zinc	1,931	0	0	Fracture alternately bright and dull, coarsely crystalline.
Ditto	2,144	0	0	Fracture lighter, bright, and more uniform than before.
Belgian zinc	4,288	0	0	Fracture brilliant white, with fewer large crystals than before.
Ditto	3,209	0	0	Fracture as before; crystals rather larger.

Unfortunately the composition of the alloys tested is not accurately given in percentage. Nevertheless, the table is of interest as showing the superior strength of phosphorus bronze. It is quite surprising that, with the number of excellent testing machines in use in this city and country, so few results have been published here, our figures being mostly limited to iron and steel.

Turkey in America.

The largest single contract ever taken in this country from a foreign nation is the \$17,000,000 one given to the Providence Tool Company by the Turkish Government. The Tool Company were three years in preparing to begin the work upon the contract, and now employ 2,500 men, who turn out 200,000 guns per year, or 600 finished guns in a day. These guns are the Martini-Henry rifles. One of the side businesses of magnitude which has grown principally out of this contract is that of the Excelsior Box Company of Providence, of which James A. L. Amoureux of this city and South Hadley Falls is treasurer. The Excelsior Box Company are now busy making 20,000 boxes per year for the Tool Company in which to ship their guns to Turkey. Each box is made to hold twenty of the guns, and with such accuracy are the groove pieces for the interior of the boxes made that they do not allow a play of even one two-hundredth part of an inch

of the arms, when packed with the muzzle tip and shoulder piece resting in the grooves. No other precaution is needed or used in packing the guns for shipment to Turkey. The machinery for the manufacture of these boxes was perfected in invention for the purpose. The company have still two years in which to complete the number of these boxes that they contracted to make; by which time, also, the Tool Company will have completed their immense contract with the Turkish Government.—*Springfield Union*.

A Remarkable Map.

About the first of January, 1876, Professor Hitchcock, of the Geological Survey, and his assistants began the construction of a raised map of New Hampshire, the design of which was to combine all the present knowledge of the geography of the State which had been obtained in the geological survey made by Professor Hitchcock, Professor Huntington, and others. This map has just been completed, and placed in the State House.

The map is fourteen feet ten inches long, representing one hundred and seventy-eight miles in length (being constructed on a scale of one mile to the inch) and ninety-three miles in width, from the mouth of the Piscataqua river to the north-west corner of Hinsdale, showing the entire surface of the State, nine thousand three hundred and thirty-six square miles. It also shows all the rivers and brooks, ponds and lakes, hills and mountains, and the town and county lines, railroads, etc. The names of all cities and towns, rivers, and principal brooks, lakes and ponds, mountains and high elevations, are given conspicuously, so that any one can find at a glance what they desire to look up. The height of the hills and mountains is given on a scale of one inch to one thousand feet, and actual measurements are given when known.

The map is constructed of pine and bass wood, and the process of the work was this: A map was first drawn on paper of the same size as the raised map, with all the outlines of towns, streams, ponds, etc., and contour lines for each five hundred feet were drawn. Tracings of the contour lines were made on inch layers of pine and bass boards, maintaining as accurately as possible the relative size and shape. These are fastened upon each other, and the valleys are beveled out with chisels.—*Concord (N. H.) Monitor*.

Torpedo Balloons.

A correspondent suggests that torpedo balloons might prove a formidable means of offence, and proposes a plan of sending up a balloon, with a torpedo attached, to windward of an enemy, and then dropping the torpedo by bursting the balloon. It seems to us that this is a good idea, and one which might find useful application in the bombardment of cities, camps, and fortified places. It is of course not practicable against an enemy capable of moving about quickly. It is not a difficult matter to construct a balloon capable of lifting sufficient nitroglycerin for the purpose. This might be inclosed in a shell and suspended as a car under the air ship. A simple mechanical device could easily be provided for dropping the load; and this device might be controlled by a light wire through which an electric current could be sent. The besiegers have only to wait for a fair wind, and then start their balloon from a point far beyond the range of the most powerful guns. It would be easy by the aid of instruments to tell just when the balloon had arrived over the desired point, and the pressure of the key would transmit the current and drop the mass of explosive. The effect of a quantity of nitroglycerin blowing up in a city or fort would be terrific. The balloon could be permitted to rise to a height beyond the reach of artillery, so that the besieged would be totally destitute of any means of directly preventing the dropping of the unwelcome visitor in their midst.

Some well meaning philanthropists in England are just now protesting against the use of the torpedo in modern warfare, as being too cruel a resort, and one which should be classed with poisoned wells and explosive bullets, which are proscribed among civilized belligerents. Probably the torpedo balloon will to them seem exceptionally barbarous. The fact is, however, that such philanthropy is a mistaken sentiment. War itself is a frightful calamity; and it is for the benefit of all that it should be as quickly ended as possible. This result can only be reached by making weapons so effective either that people will not face them, and thus fighting may be stopped in that way, or else that they will produce such wholesale destruction as to secure victory for one side or the other in the quickest possible period. The most destructive weapons are therefore the most merciful; and in this light the torpedo should be regarded.

Russian Gold and Silver Production.

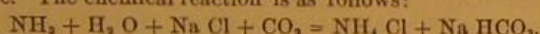
The following statistics of the yield of the Russian gold fields for the year 1876 show that this source of wealth is considerable in that cold northern clime. The amount of gold mined in 1876 was 1,617 pounds, equal to 71,503 lbs. troy, having a value of 22,086,662 roubles = \$17,689,329.60. The silver amounted to only 156 pounds, or 5,616 lbs. avoirdupois, worth 142,360 roubles = \$113,888.

NICHOL'S RAILROAD JOINT AND NUT LOCK.—In our recent illustrated article on this subject, the statement that the joint would be safe without any bolts "on the same section of rail" should read "on some sections of rail." Also for "requires no spikes in the flange of the rail," read "slots or notches" for "spikes."

A NEW LECTURE EXPERIMENT.

BY E. J. HALLOCK.

To illustrate the principle employed in the manufacture of soda ash by Solvay's ammonia soda process (see SCIENTIFIC AMERICAN of June 24, 1876), as also the method employed in carrying it into practice, the author employs the following simple apparatus, consisting of a wide mouth bottle, a flask, and a chloride of calcium drying tower, such as may be had of all dealers in chemical glassware, and which are to be found in most laboratories. The chloride of calcium tower, C, is nearly filled with a clear saturated solution of common salt. At *g* is placed a disk of wire gauze, and other disks may be placed at *A* and *i*, if convenient. In the bottle, A, is generated carbonic acid gas which passes down through B, and enters the tower, C, at *b*. In the flask F, ammoniacal gas is evolved, either by boiling strong aqua ammonia, or by heating together slaked lime and sal ammoniac. This gas enters the tower, C, through a tube, E, which dips but an inch or two beneath the surface of the liquid, *k*. The tube, D, may lead into a second tower similar to C, or merely dip into a beaker of water. The funnel tube, *a*, should be somewhat longer than the height of the tower, C, so that the pressure of the column of liquid, *a a'*, shall be equal to that of a column of brine equal to *bk*. It was found by experiment that in order to overcome a pressure of 12½ inches in C, and 1½ in D, the column, *a a'*, was 16 inches or more. The flask, F, should also have a long safety tube. In a few minutes after the gases begin to be evolved, the liquid in C becomes milky from the formation of bicarbonate of soda, which is kept in suspension by the motion of the gas. In half an hour the operation is interrupted, when the bicarbonate of soda will soon settle on the bottom of the tower and on the disks of wire gauze, although the liquid remains turbid for some time. The chemical reaction is as follows:



The chloride of ammonia remains in solution and may be drawn off at *b* without disturbing the bicarbonate of soda. The conversion of the bicarbonate into the carbonate of soda by heat is too simple to need illustration.

Columbia College Laboratory, New York city.

THE SECRETS OF THE MYSTERIOUS CLOCKS.

We have frequently placed before our readers descriptions of wonderful clocks, consisting usually of a mere plate of glass on which two hands, apparently destitute of any mechanism, mark the hours, and which return to their proper position, even if moved therefrom. No detailed account of the mechanical construction of these curious devices has appeared until recently, when a committee of the French Society for the Encouragement of National Industry undertook an investigation, the result of which is an excellent illustrated report which we find in the "Bulletin" of that association.

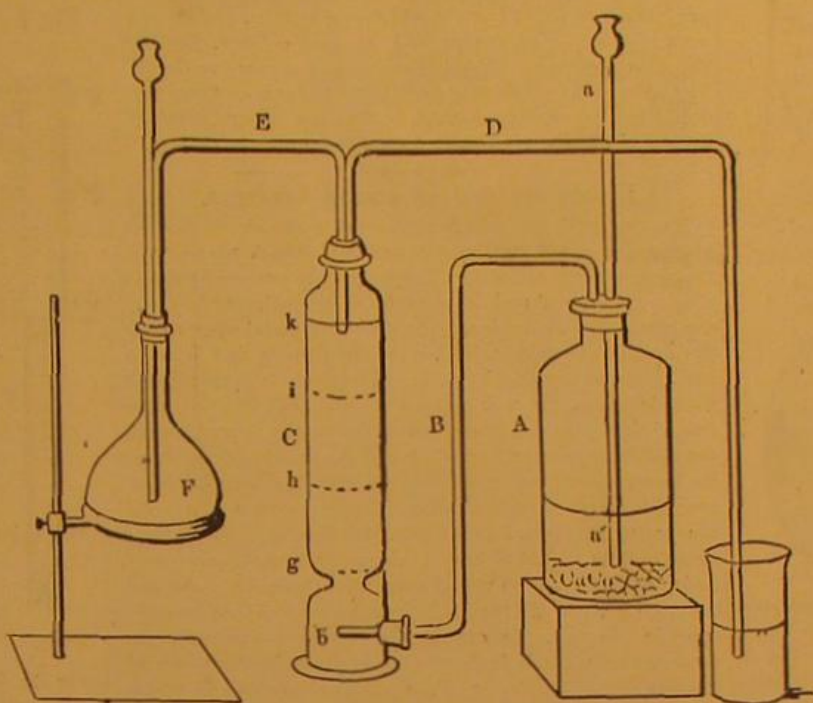
The inventor of the principal forms of mysterious clock now extant is M. Henri Robert, a French chronometer maker. The principle on which the machinery is based is not wholly new, as some half a century ago single-hand clocks, marking hours only, were made on the same plan. The single hand was mounted on a horizontal pivot, and carried, at the extremity opposite to the indicating point, an enlargement like a watch case, which seemed placed there simply for purposes of ornamentation. In this case, however, was concealed a watch train, which once in twelve hours caused the revolution of a little platinum weight around the inner periphery of the box. If we refer this weight and the remainder of the hand to their respective centers of gravity, the center of gravity of the entire arrangement will be found by dividing the distance which separates the two points according to the inverse ratio of the two masses. With relation to the center of gravity of the hand alone, the center of gravity of the combined hand and box will then describe a curve similar to that traversed by the platinum weight, which is a circle. But the system ob-

viously cannot remain in equilibrium in any position unless the center of gravity be directly over the pivot. Therefore, as the center of gravity describes a circle, the hand must likewise move in a circular path in the opposite direction to that of the weight in the box; and as the weight accomplishes its rotation in just twelve hours, the hand will do likewise. It will further be seen that, as the moving of the hand from its proper place does not affect the operation of the clockwork in the box, the hand will always return to the only position in which it can be in equilibrium with the weight.

M. Robert has devised two clocks. In one, the hands com-

the case being closed. Fig. 9 shows the front face also of the same hand, the box cover off; and Fig. 10 is an elevation of the same. A is a circular dial composed of a simple plate of glass on which the hours are marked. B is the minute hand. C is the movement box, and D the watch train within. E is a small dial divided into intervals of 5 minutes each (Fig. 9). F is a pin and also a hand which moves on the dial, E. The winding stem is shown at G, and at H is the usual watch-regulating device. I (Fig. 7) is the platinum weight, of flat segmental form. This is supported by the arm, J, Fig. 7, which is fixed on one of the ends of the axis which carries at its other end the pin, F, Fig. 9. In order to regulate the movement, it is necessary to place the hand, F, on the same minute mark on E as the hand, B, indicates on the dial, A. At the opposite end from that to which the case is affixed, the minute hand, B, terminates in a star, below the center of which is a counterweight, K (Fig. 7), held by three adjusting screws. By the latter the weight, K, may be so moved as to balance the hand accurately.

The hour hand, B', Figs. 1 and 10, is of the same shape as the minute hand: but its case, placed on the end simply for symmetry, contains no movement. The operation of this hand is governed by the following mechanism: L is a plate fixed on the front face of the dial, A, Fig. 1. It is held in place by another plate, with screws disposed on the other side. M is a tube passing through plate, L, and inclosing the axis, N, of the minute hand. This axis is concentric with the tube, M, and the conical ends of its enlarged central portion bind on corks in said tube. Fig. 2 shows this axis separately. Riveted on the front portion of tube, M, is a disk, O. P is a minute wheel, carrying at the center a pinion, and mounted loose on an axis fixed to the disk, O (see detail in Fig. 3). Q is a pinion, with a sleeve adjusted for friction on the outer enlargement of the axis, N, and en-



THE AMMONIA SODA PROCESS.

communicate. One hand is operated as above described, but its weight travels twelve times faster, so that the hand completes its circuit in one hour, and therefore marks minutes. By a simple concealed train it is connected with an hour hand and transmits motion to it. If the minute hand be whirled around by the finger, on being released it will of course return to its proper place. The hour hand, however, will not, unless the number of rotations imparted to the minute hand happens to be a multiple of twelve.

In his second invention M. Robert uses independent hands. Instead of there being a train uniting them, each hand has its own motive apparatus. One accomplishes its rotation

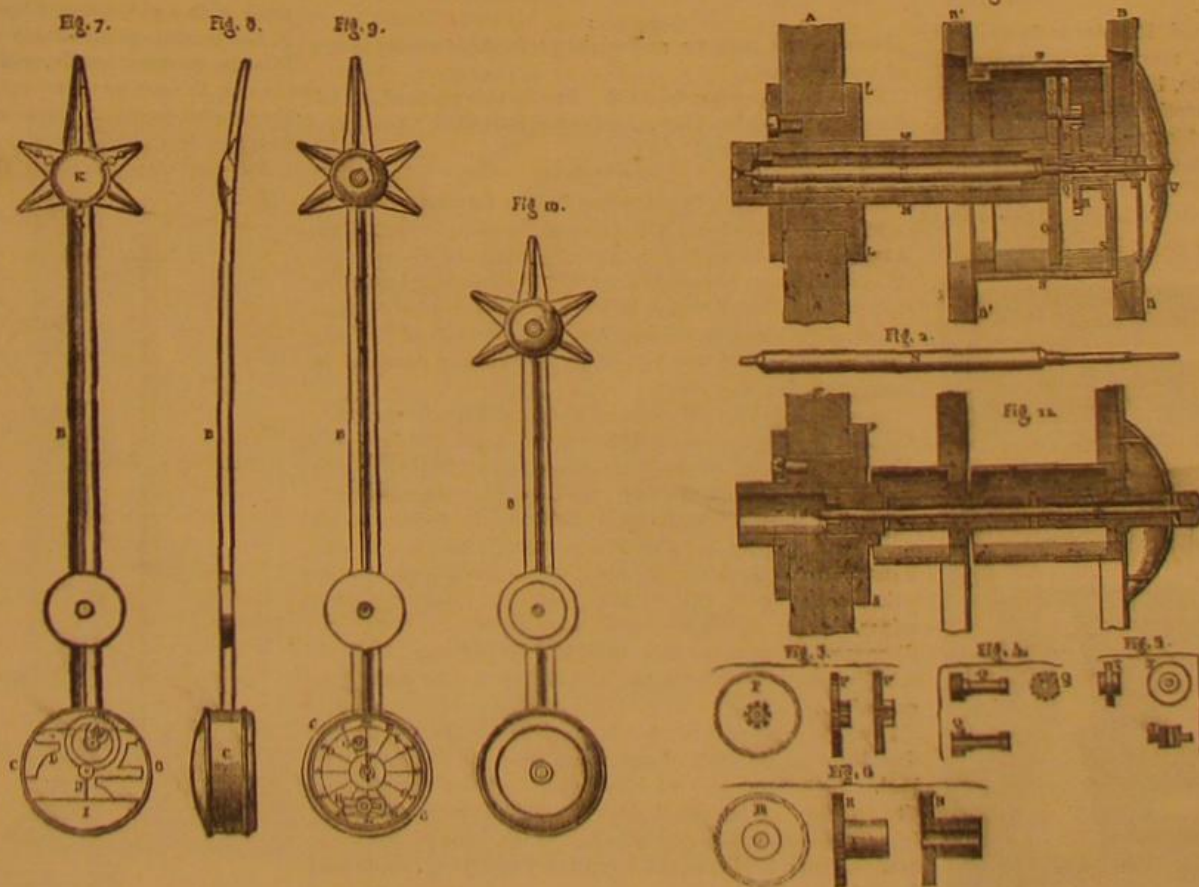
gaging with the wheel, P, Figs. 1 and 4. R is an hour wheel mounted on the sleeve of pinion, Q (Figs. 1 and 6), and engaging with the pinion of the minute wheel, P. S is a light case attached to the sleeve of wheel, R. It covers disk, O, and all the train, and is attached by a screw to the hour hand, B', Fig. 1. T is a barrel mounted for friction on the prolonged end of axis, N, and turning therewith. To this barrel the minute hand, B, is secured. At U is a fastening disk and pin. The minute hand, B, is moved by the travel of the weight in the case attached to its extremity. In turn, it causes motion of the axis, N, which (through the pinion, Q, of the wheel, P, the pinion of the wheel, R, and the box, S) operates the hour hand, B'.

Fig. 11 is a vertical section of the mechanism of the clock with independent hands; *a* is a dial analogous to that in Fig. 1; *b* is a plate disposed similarly to plate, L, already described; *c* is a cork mounted for gentle friction in the central tube of plate, *b*; *d* is the axis of the hands; *e* is a tube carrying the hour hand and turning freely on axis, *d*; *f* is the barrel which carries the minute hand. A small steel disk is placed between barrels, *e* and *f*, to each of which the hands are connected by sleeves. The hands are balanced by counterweights to their ends, as previously described.

The Iron Industry in Greece.

The Athens correspondent of the *Deutsche Industrie Zeitung* writes that the manufacture of iron, which was begun a few years ago by a metallurgical association in Athens, has been abandoned because of the scarcity of stone coal, although brown coal is abundant in Greece.

The writer suggests that German iron makers could purchase iron ore in the island of Seriphos at very low prices. These ores are brown hematite, red hematite, and specular ore, which can and will yield 25 to 30 per cent of metallic iron. These beautiful ores can be bought for 10 francs (\$2) per ton. One deposit of these ores is calculated at 500,000 tons, and the island thus rich in iron ore has been named "Sidera Nesos," or Iron Island.



ROBERT'S MYSTERIOUS CLOCKS.

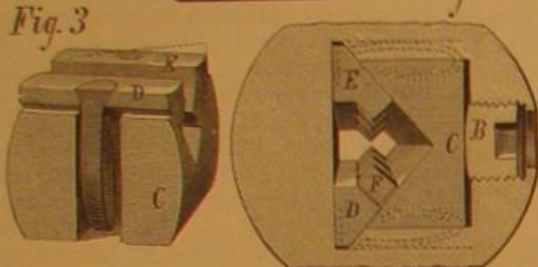
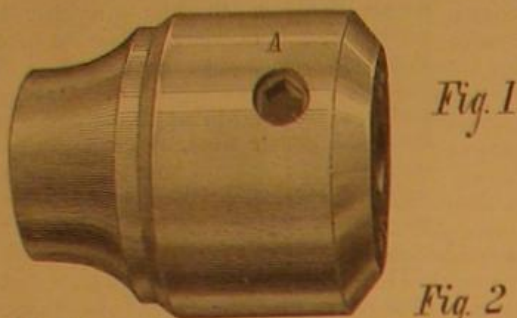
in 12 hours, the other in 1 hour. Hence, either or both hands may be disturbed, and both will return to mark the exact time.

Figs. 1 to 10 in the annexed illustrations relate to the clock of the first-mentioned type. Fig. 1 is a partial vertical section, passing through the axis of the hands. Figs. 2, 3, 4, 5, and 6 represent details. Fig. 7 shows the rear face of the minute hand, the under cover of the movement case being taken off. Fig. 8 is a profile view of the same hand,

FROST'S VARIETY SELF-CENTERING CHUCK.

We can commend the new chuck represented in the annexed engraving as one of the best that we have ever seen. It embodies a mechanical construction which enables the implement to hold tools of any form of shank; it is perfectly self-adjusting, its wearing surfaces are exceedingly large; it has no gearing or multiplicity of parts; and the way in which the four simple proportions are made to answer all the various requirements strikes us as a remarkable exhibition of inventive ingenuity.

The chuck consists, first, of the outer casing or collar, Fig. 1. In this there is an aperture which receives the screw,

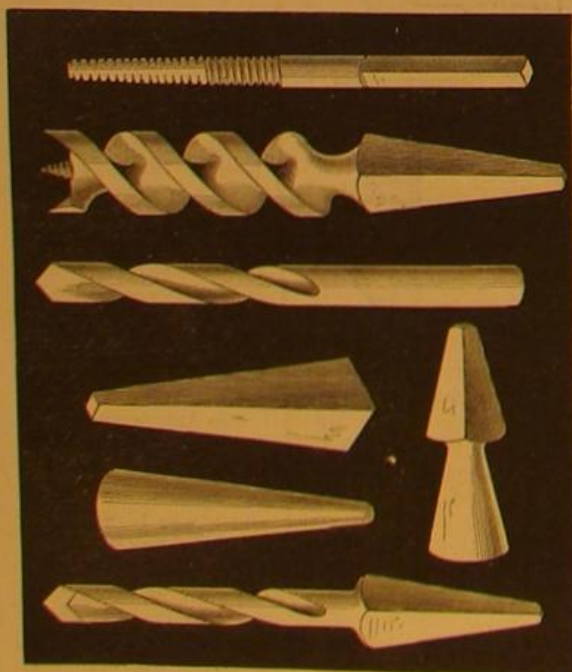


B, Fig. 2. Said screw has a square recess in its head, and is turned by an ordinary key. The lower end of the screw bears on the jaw, C, Fig. 3. The under face of this jaw is V-shaped. In each of its sides is a recess to accommodate the bent springs, which are attached to the jaws, D and E. These jaws bear flat against the case, and, by their inclined sides, bear also against the V of jaw, C. They are provided with projections at F.

From Fig. 2 it will be evident that, if the jaw, C, is pressed down, its inclined faces, acting on the upper inclined sides of jaws, D and E, will force said jaws together, and as contact becomes closer, the projections, F, on the latter will interlock. The square-shanked tool will then be held on two sides in the V of the jaw, C, and on the other sides by the proximate parts of jaws, D and E; and the tool will be the more tightly held as the screw, B, is turned down. When the screw is relaxed and the tool removed, the springs on jaws, D and E, will expand, and the jaws will thus be carried back to their former places. It will be observed that these springs have no actual duty to perform. There is no strain upon them, and their only office is to draw the two light pans back again into place.

Now if a tapered tool be inserted, in order to fit its shank, the two moving jaws, D and E, must assume an angular position. This they can easily do, because their springs are single and attached to them directly at the middle of their length, so that they can pivot on the springs. Also the upper jaw rolls on the screw end; and there is abundant space between its top and the casing to allow of considerable angular movement. Its front sides, as shown in Fig. 3, are curved,

Fig. 4.



so that this radial or balancing movement does not alter the length of the aperture which it aids in forming. The device is one of those which, although comprehensible at a glance, is difficult to explain; but the shape of the tapered orifice formed will, we think, readily be understood from Fig. 2. As the jaws adjust themselves, being perfectly free to adapt their movement to any shaped object placed between them, it is no longer material that tools be provided with a uni-

form shank. In Fig. 4, we have represented a variety of forms covering those in common use. These we have tested in the chuck, and it holds them all with equal facility, accurately, and in true center.

For further particulars address the inventor, Mr. William Frost, 53 Dartmouth street, New Bedford, Mass.

Application of Electricity in Dyeing.

According to the *Bulletin de la Société Industrielle de Mulhouse*, Goppelsroeder has observed that if an electric current is passed through aniline dye becks decoloration ensues, with formation of colorless salts of lenkaniline. If yarns or cloths are steeped in the liquid they absorb it, and on subsequent exposure to the air they become colored, just like the goods drawn out of an indigo vat and exposed to the air. The colors thus obtained are said to be faster than those produced by the ordinary method. Whether this principle of dyeing will prove practically useful remains to be seen.

A NEW METHOD OF SECRET WRITING.

The annexed engraving represents a simple device for purposes of secret writing, by means of which may be prepared communications intelligible only to persons having a similar apparatus, and impossible to be deciphered by any one else. The device is simply a sheet of metal upon which the alphabet is written in two parallel rows, and beneath each letter an opening is made. The plate is inclosed in a suitable frame. It will be seen at once that, if this apparatus is laid over paper, and dots made on the latter through the apertures—under A, B, C, for example—the marks when the paper is removed will have no signification. If, however, the recipient of the communication should place over the paper an apparatus of precisely similar construction, then the dots would of course show through the apertures under A, B, C; and he would know that those letters formed the message. It will readily be seen how words can be indicated in this way. In cases where letters are placed in inverse order, a small inclined line is drawn through one of the side slots in the frame. This indicates the mode in which the letters should be read. Double letters are indicated by vertical lines in place of a simple dot, and words are separated by a horizontal dash. The invention seems excellently



adapted to the purpose, and might preferably be used in lieu of cipher codes.

Patented December 26, 1876. For further particulars, address the inventor, Rev. Alexander Berghold, New Ulm, Brown county, Minn.

Captain Burton's Discoveries in the Land of Midian.

A correspondent of the *London Times*, writing from Alexandria, informs the public that Captain Burton, the African traveler, has made a "find" of unusual interest. At the request of the Khedive he has visited the land of Midian, the desolate region on the eastern side of the Gulf of Akabah, the easternmost of the two long and narrow estuaries in which the Red Sea ends.

Accompanied by M. George Marie, a French engineer, Captain Burton landed in Midian on 2d April, and in an exploration of some weeks explored a region full of ruined towns, built of solid masonry, with made roads, aqueducts five miles long, artificial lakes and massive fortresses, all marking a wealthy and powerful people. Their wealth was based on mining operations, and Captain Burton reports the existence of gold, silver, tin, antimony, and turquoise mines. The auriferous region is extensive; indeed, the discoverer believes he has opened up a California, and the Khedive proposes to have the country worked by European capitalists.

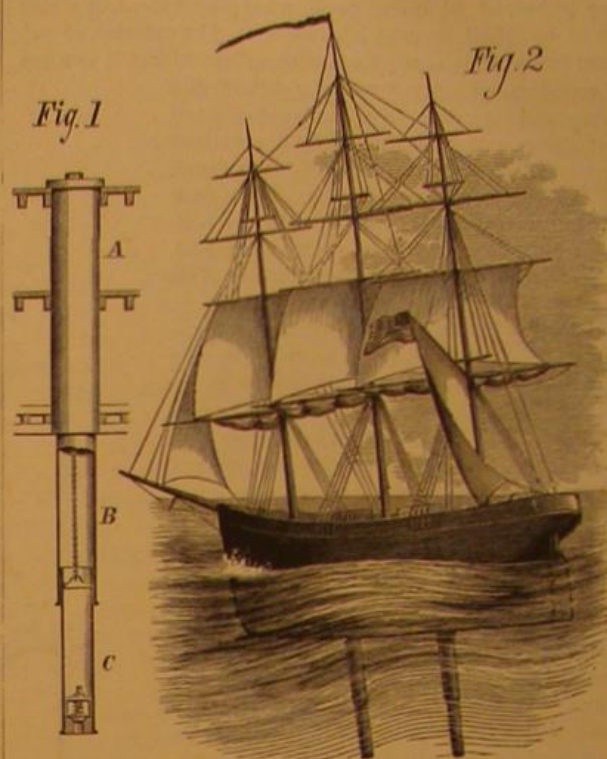
It will be remembered that in the Bible, Midian is always described as a land full of metals, especially gold, silver, and lead. It is more than probable that Solomon's Ophir was situated there, as the small ships in which he imported gold, ivory, and peacocks were launched at the head of the Red Sea. Midian is part of the Egyptian Viceroyalty.—*London Spectator*.

IMPROVED BALLASTING TUBE FOR VESSELS.

The invention illustrated herewith consists in providing vessels with a series of pipes extending from their bottoms to the depth of about thirty feet. The pipes are telescopically constructed, so that they may be easily lowered below or raised up within the hull of the vessel. The inventor claims that this device, as it enables the ship's center of gravity to be lowered, will prevent vessels rolling or capsizing, check their leeway, and obviate the use of ballast or drags.

The construction of the tubing is shown in Fig. 1. Fig. 2

exhibits its application to the vessel. A large pipe, A, extends upward from the keel to the spar deck and serves as a well. Through a suitably packed collar in the lower portion passes a second tube, B; and through the latter, a third tube, C, in the bottom of which is a valve, held down by a spring which yields and allows the valve to open when the tubes descend, so that they may become filled with water. A chain, attached as shown to tubes, C, serves to raise and



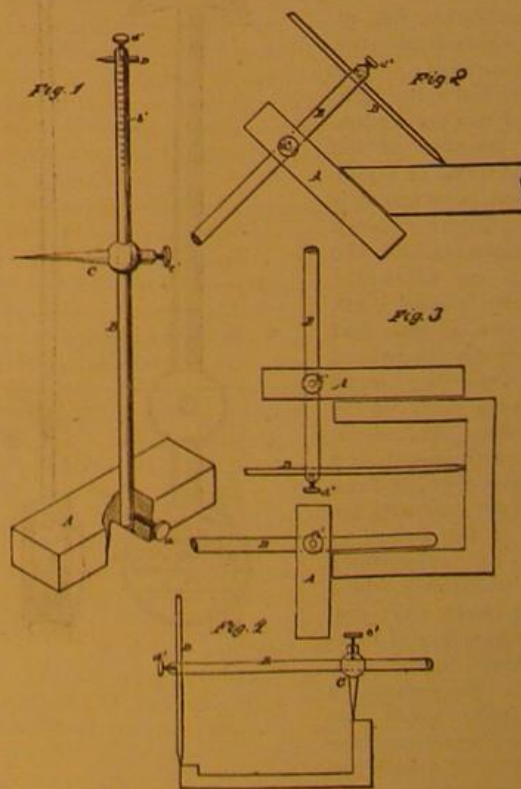
lower the device as desired. The tubes may be arranged to pass directly through the keel, or they may be disposed on each side of the same.

Patented April 10, 1877. For further particulars, address the inventor, Rev. Alexander Berghold, New Ulm, Brown county, Minn.

IMPROVED GAUGE.

Mr. Benjamin F. Stoner, of Rockford, Ill., has patented through the Scientific American Patent Agency, May 1, 1877, an improved instrument, which may be used as a gauge for all irregular surfaces and for work which an ordinary gauge cannot reach. It may also be used as a marking gauge, as a try square, and as a trammel.

A represents the head, which is rectangular in form, and may be plated with metal to prevent wear, and which receives the rod, B. The latter is secured in place adjustably by a set screw, a'. C is the pivot finger of the trammel, which is made with a globe socket upon its base to receive the rod, B, and is secured adjustably upon said rod by a set screw, c'. D is the marking needle, which is passed through a hole in the rod, B, near its outer end, and is secured in place adjustably by a set screw, d', passing in through the end of the said rod, B. The needle, D, may be made short, as shown in Fig. 1, for convenience in using the instrument as an ordinary



marking gauge, or long, as shown in Figs. 2, 3, and 4, to adapt it for use for gauging irregular surfaces, and for use as a trammel. Upon the rod, B, is formed a scale, e, of division marks. When the instrument is to be used as a square, the rod, B, can be adjusted to any desired length, and can be used where the blade of an ordinary square would render it inconvenient to use it, or prevent its use.

AN INTERESTING MARMOSET.

We select, from the pages of the *Illustrated Sporting and Dramatic News*, the accompanying engraving of a recent arrival at the world-renowned Zoological Gardens, situated in the Regent's Park. The look of intelligence and docility on his countenance much resembles that seen on the face of a King Charles' spaniel; but his feet and claws are evidently made for mischief, and he is not therefore suited for a domestic pet, although his dimensions (the engraving is of the size of life) adapt him to be carried in the vest pocket or attached as a pendant to a watch chain.

The marmoset is a South American monkey, much resembling a squirrel in form and agility; and the *marikiea*, or silky marmoset, is of a golden yellow color, its fur being very soft and of the color of raw silk, deepening in shade on the paws. It is, in its natural state, very clean in its habits; and if not properly attended to when in captivity, it pines away and dies. Its usual voice is gentle, but it hisses loudly when irritated. The *leoneito*, or leonine marmoset, is endowed with a mane of considerable proportions, which it erects when angry. It is the smallest known animal of the monkey tribe.

Preservation of Aqueous Tartaric Acid Solutions.

One of the chief objections to the use of tartaric acid as a reagent or in alkalimetry is the readiness with which its aqueous solutions decompose. The detection of potash in solution is difficult, owing to the solubility of all its neutral and most of its other salts. The acid tartrate of potash is soluble in 200 parts of cold water, while the double chloride of platinum and potassium dissolves in 140 parts cold water; hence tartaric acid is a more delicate test than chloride of platinum. Professor Wittstein announces the discovery of an easy method of preventing decomposition in the use of salicylic acid. A freshly prepared solution of 1 part tartaric acid in 5 parts water, has added to it about $\frac{1}{1000}$ part salicylic acid. In an unprotected solution of tartaric acid, the well known flocks appear in two weeks; while a relatively small quantity of salicylic acid has kept a solution pure and clear for three months, and may, he expects, preserve it unaltered for a year or more, a question which can only be settled by time. Dr. Wittstein claims also that tartaric acid solutions may be used in alkalimetry, as the amount of acid does not change for a year even when these slimy flocks form in the solution. We see, however, no reason to prefer this acid to the more permanent oxalic acid, when an organic acid is desired for a normal acid solution.

AN ARTIFICIAL MAMMOTH.

M. Martin, a German naturalist, has recently constructed artificially a mammoth (*elephas primigenius*) of the quaternary epoch, after the many fine fossils of that extinct animal now existing in the Natural History Museum of Stuttgart. The form of the body of the gigantic creature, its trunk, tusks, and hair (the latter a close imitation of that of the real animal found in the Siberian ice) have been wonderfully counterfeited, so that the resemblance is as accurate as if the mammoth's skin had been stuffed. The animal, a representation of which is given in the annexed engraving from *La Nature*, measures 16 feet in height by nearly 26 feet in length. It is made upon a wooden framework, covered with wire cloth, the latter being coated with *papier maché*. The hair is reproduced from the fiber of an Indian palm, the tusks are of wood, and the trunk is ingeniously made of paper.

We are glad to notice that this valuable work has been purchased by Professor H. A. Ward for his Museum of Zoology and Comparative Anatomy in Rochester, N. Y. It has already been packed, and is now on its way to this country.

Coating Metals with Platinum.

A Frenchman named Dodé recommends the following process for coating cast iron, whether rough or enameled, with platinum: The metallic articles are first moistened by means of a brush dipped in oil of turpentine, then immersed in a mixture of borate of lead and oxide of copper, and baked in an oven. When thus prepared, they are dipped into a mixture of borate of lead, litharge (or massicot), chloride of platinum, ordinary ether, oil of lavender, and amylic ether, and then heated.

New Method of Manufacture of Steel Armor Plates and Blocks.

The trials of the 100 ton gun at Spezia resulted in some remarkable deductions in favor of steel armor, and it now



MARMOSET AT THE ZOOLOGICAL GARDENS, LONDON.

appears probable that steel plates will supplant iron in the armament of war vessels. Mr. James Yates, of Rotherham, England, has patented, March 13, 1877, a new process of making steel blocks for armor purposes, which is as follows:

Molten steel of one temper or hardness is run into an open or closed mould, and then upon its upper surface a second layer of molten steel of another temper or hardness is added. Its operation is repeated so as to form as many strata of a

Mr. Thomas Edward, the Scotch naturalist whose pursuit of Science amid toil and privation has gained him such just renown, writes as follows concerning the tern. He was, one afternoon in August, watching the evolutions of a flock of these birds, which were engaged in fishing in the Firth of Boyndie. He was seeking an opportunity to bag one of the beautiful creatures, when, as if in answer to his desire, a noble specimen directed its course to the shore, fishing all the way as it came.

"Once more he soars aloft on lively wing, and, having attained a certain elevation, and hovering, kestrel-like, for a little, with quick repeated strokes of his pinions he rapidly descends. Again, however, his hoped-for victim has made his escape; and he bounds away in an oblique direction, describing a beautiful curve as he rises without touching the water. Shortly after he wings his way nearer and nearer to the beach; onward he advances with zig-zag flight, when suddenly, as if struck down with an unseen hand, he drops in the water within about thirty yards of the place where I am standing. As he righted and sat on the bosom of the deep, I was enabled distinctly to perceive that he held in his bill a little scaly captive, which he had snatched from its home, which struggled violently to regain its liberty. Its struggles were in vain; a few squeezes from the mandibles of the bird put an end to its existence.

"Being now within my reach, I stood prepared for the moment when he should again rise. This he did as soon as the fish was dispatched. I fired, and he came down with a broken wing, screaming as he fell into the water. The report of the gun, together with his cries, brought together the party he had left, that they might ascertain the cause of the alarm. After surveying their wounded brother round and round, as he was drifting unwittingly toward the shore with the flowing tide, they came flying in a body to the spot where I stood, and rent the air with their screams. These they continued to utter, regardless of their individual safety, until I began to make preparations for receiving the approaching bird. I could already see that it was a beautiful specimen; and I expected in a few moments to have it in my possession, being not very far from the water's edge.

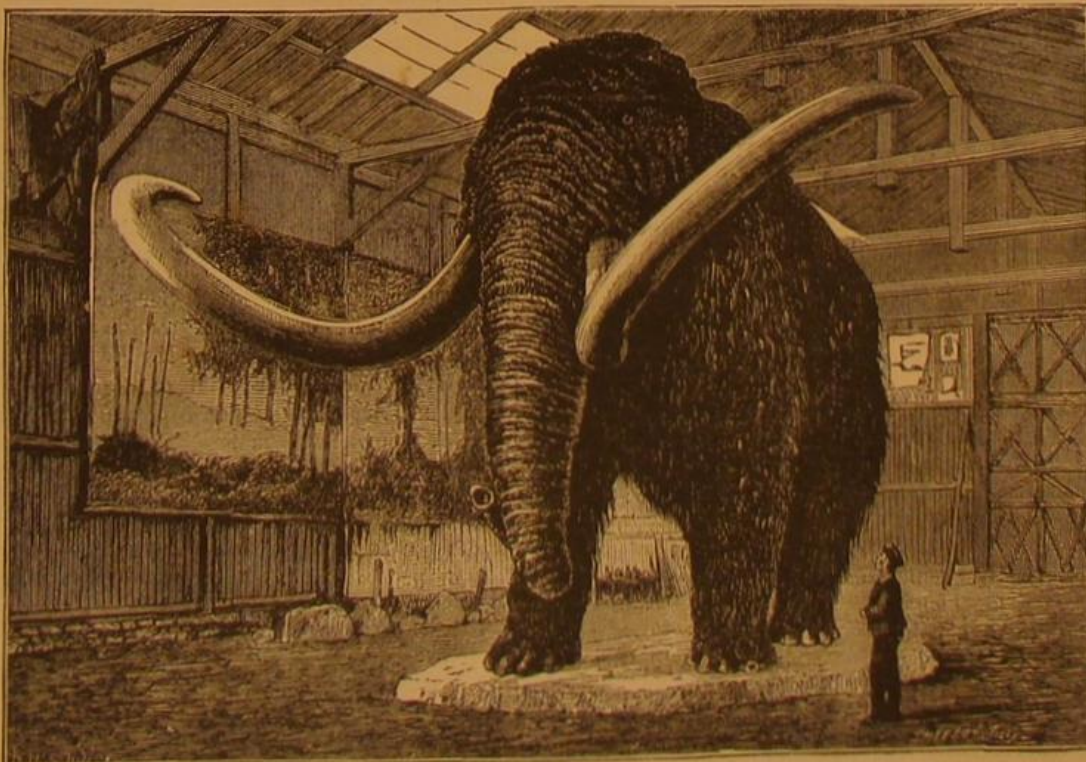
"While matters were in position, I beheld, to my astonishment and surprise, two of the terns take hold of their wounded and disabled comrade, one at wing, lift him out of the water, and bear him out seaward. They were followed by two other birds. After being carried six or seven yards, he was left gently down again, when he was taken up in a similar manner by the two who had been hitherto inactive. In this way they continued to carry him alternately, until they had conveyed him to a rock at a considerable distance, upon which they landed him safely. Having recovered my self-possession, I made towards the rock, wishing to obtain the prize which had been so unceremoniously snatched from my grasp. I was observed, however, by the terns, and, instead of four, I had in a short time a whole swarm about me. On my near approach to the rock, I once more beheld two of them take hold of the wounded bird as they had done already, and bear him out to sea in triumph, far beyond my reach. This, had I been so inclined, I could no doubt have prevented. Under the circumstances, however, my feelings would not permit me; and I willingly allowed them to perform without molestation an act of mercy, and to exhibit an instance of affection which man himself need not be ashamed to imitate. I was, indeed, rejoiced at the disappointment which they had occasioned, for they had thereby rendered me the witness of a scene which I could scarcely have believed, and which no length of time will efface from my recollection."

Eo Snakes Catch Fish?

Mr. J. Y. Detwiler, of Toledo, Ohio, states that, on May 20 last, he killed a water snake in a small brook, which, when opened, was found to contain a fish, about 6 inches long, partly digested. He also has caught water snakes on trout lines baited with minnows; and he once caused a water snake to disgorge a fish about 8 inches long.

Yield of Wine in France.

The wine crop of France in 1876 was only 41,846,748 hectoliters (a hectoliter = 23 gallons), as compared with a yield of 83,836,391 hectoliters, or more than twice the quantity in 1875. The disease of the vines has caused this unfavorable result.



M. MARTIN'S ARTIFICIAL MAMMOTH.

different tempered steel as may be desired, arranged according to their temper or hardness, forming thereby one solid and compact compound mass. This may be either at once ured or be stamped, rolled, or pressed, to give the form required, and to impart strength to bear greater pressure or strain tensibly, compressively, or by impact from projectiles or heavy blows. The molten steel, of varying temper and hardness, is successively poured into the mould before the preceding stratum is cold.

A TUNNEL under the Pyrenees, uniting France and Spain, will be opened at the beginning of next year.

Science in War.

The present Russo-Turkish war cannot well be less interesting than those that have so recently preceded it, and we may especially point out two directions in which fresh examples of scientific warfare will probably manifest themselves—in connection, namely, with the cavalry pioneer and the Whitehead torpedo. Both of these will probably be seen in warfare for the first time, and before many days are past we may hear of their doings in action. The cavalry pioneer must not be confounded with the Prussian uhlán, who played so conspicuous a part in the last war. The ubiquitous uhlán, terrible as he was, did not work the injury which some of the Cossacks will have it in their power to inflict if accounted as pioneers. These are selected from the smartest and most daring troopers, lightly armed and well mounted. In a belt round their waists they carry a few pounds of guncotton or dynamite, and with this highly destructive explosive they may work incalculable harm. A small charge of guncotton placed simply upon a rail and fired with a fuse suffices to blow several feet of the iron to a distance of many yards, thus rendering the railway unserviceable on the instant. A trooper may dismount, place a charge at the base of a telegraph pole, fire it, and be in his saddle again within 60 seconds. Wires may thus be cut and communication stopped in the heart of an enemy's country by fearless riders, who have but to draw rein for an instant to effect the mischief, while lines of railway in the neighborhood are entirely at their mercy. Even light bridges and well built stockades may be thrown down by the violent detonation of compressed guncotton, and forest roads considerably obstructed by trees thrown across, which are never so rapidly felled as when a small charge of this explosive is fired at their roots. The influence of the Whitehead torpedo, of which we have heard so much of late, will likewise be felt for the first time during the present war. An implement so ingenious in its character that, as Lord Charles Beresford the other day happily remarked, it can do almost anything but talk, is in the possession of both belligerents, and will doubtless be heard of before long on the Danube and in the Black Sea. These torpedoes are manufactured at Fiume on the Mediterranean, and, like Krupp guns, are to be purchased by any one who chooses to pay for them.

The Sutro Tunnel.

Considerable interest is now being taken in the progress of the Sutro tunnel, as it is advancing quite rapidly towards the Comstock, and is only 2,800 feet east of the workings of the Savage mine. At the date of the last measurement the total length of the tunnel was 16,913 feet. The *Enterprise* is authority for the statement that the tunnel has, during its progress thus far, cut twelve separate and distinct ledges, yielding assays of from \$2 to \$20. One of them was 112 feet in width; yet not a foot of prospecting has been done in either side of the tunnel. These statements are of interest as showing the immense lateral extent of the Comstock deposits. Other ledges may yet be struck by the tunnel in its course, any or all of which may be worked on the completion of the tunnel when they have time to turn their attention to mining.

At present, of course, the whole energies of the company are directed to putting the header along as fast as possible, so as to get at the Comstock. There is not so much opposition to the project as formerly among the mine owners and property owners of Virginia and Gold Hill, and it is conceded that the tunnel will save great expense in draining the mines. Still they object to the two dollars per ton royalty on ores; but if it is proved that the tunnel will drain and ventilate the mines, they can afford easily to pay that sum without grumbling. The projectors of the enterprise have shown indomitable pluck and energy in carrying out the plan amid so many difficulties; and even if the tunnel is not constructed as it should be, as some aver, there will be plenty of opportunity to enlarge, strengthen, and improve it, when the Comstock is reached and funds are more plentiful.—*Mining and Scientific Press.*

Nickel Plating.

Some time ago Herr Stolba published a method of plating iron and steel with nickel by the simple immersion process, and the following plan has been recently put forward by him as an improvement: To a dilute solution (5 to 10 per cent) of sulphate of nickel to which as much as possible, there is added enough sulphate of zinc to color it strongly green. This is heated to ebullition in a porcelain vessel. The objects, being completely cleaned of grease, are then suspended in the liquid so that they touch each other as little as may be; and the boiling is kept up for from half an hour to an hour, water being from time to time added in place of that evaporated. The nickel is precipitated in a brilliant white layer wherever the surface of the object is not greasy or rusty. The operation can be continued for several hours if desired; but the plating will not thus be rendered much thicker. After removing the objects, they are washed with water holding chalk in suspension, and carefully dried. They may afterwards be cleaned with chalk, and they take a fine yellowish-toned polish. The chloride of zinc used should contain no metal precipitable by iron. When it cannot be obtained of sufficient purity, it may be made by dissolving zinc scraps in hydrochloric acid, and allowing the solution, containing an excess of metallic zinc, to rest, in order that the metals precipitable by the zinc may separate. Filter at the end of 24 hours, and the solution is ready for use; each portion of zinc dissolved corresponds to about 2.1 parts of chloride of zinc. The sul-

phate of nickel should also be as pure as possible, and the cold solution should not precipitate when a plate of iron is plunged in it, as would happen, for example, if it contained copper. When during the operation the liquor becomes a pale green, owing to the precipitation of nickel, more sulphate must be added until the intense green is regained. When the used liquid is exposed to the action of the air, it deposits hydrated oxide of iron, coming from the dissolved metal. It should be filtered, and more chloride of zinc and sulphate added, when it may be again used. In the same way, polished iron and steel objects may be covered with a brilliant plating of cobalt, by using a sulphate of cobalt solution. The appearance of this plating differs little from that of polished steel. The distinguishing characteristic is the light rose-colored tint. The author states that the plating wears well.

Glycyrrhizin.

The word "glycyrrhizin" is the name applied to the active principle of the licorice root, which bears the botanical name of *glycyrrhiza glabra* and *g. echinata*. It has usually been described as an amorphous, yellowish-white powder. Habermann has succeeded in preparing from the commercial article sold by Trommsdorff, by treating it with a considerable quantity of glacial acetic acid, an almost colorless substance, which crystallizes from alcohol in prismatic needles which usually form hemispherical masses. This substance is extremely soluble in water and in strong alcohol, less soluble in absolute alcohol, and as good as insoluble in ether. It has an intensely sweet taste, with an irritating after-taste, and in many of its properties corresponds remarkably with glycyrrhizin as described by Gorup-Besanez in 1861. An alcoholic solution of this with an alcoholic solution of calcium chloride gives a white flocculent precipitate, and a similar precipitate is obtained by mixing an alcoholic solution of glycyrrhizin with one of sugar of lead. When the crystallized glycyrrhizin is boiled with water containing 2 per cent of sulphuric acid, a solid resinous substance of a light Isabella yellow color separates, which, however, differs from that described by Gorup-Besanez in having the characteristic sweet taste of glycyrrhizin. The amount of carbon in the crystalline substance differs by several per cent from that in the substance described by Gorup-Besanez. Habermann is continuing his investigation of the new substance and its derivatives.

Dyeing Loose Cotton.

The working up of cotton and wool into all sorts of fabrics has of late years received much development, so that now 25 to 30 per cent of loose cotton may be added to wool, and the fabrics so woven actually deceive the naked eye of the experienced dealer; the only difficult point is to dye the cotton well and fine. It may, therefore, be interesting to quote a cotton-dye method which has been found to answer the purpose well.

With fabrics that do not require to be fulled, all colors can be produced to resemble the tints of wool. The loose cotton, as it proceeds from the ball, may be loosed either by mechanical or manual labor, and as soon as each raw cotton yarn has been boiled two hours in water, it is ready for dyeing; but that manipulation may be saved in most colors by immersing the cotton: as, for example, for black, into a logwood bath for two hours, by which time is saved. The chief thing to attend to during the boiling process is to turn the cotton incessantly, so as to insure that all portions may be soaked through, otherwise non-dyed white spots would show up. It is also advisable to use separate vats for each bath, by which much dye material may be saved, as the subsequent baths then require less fresh dyestuffs or salts; if the baths have, however, been used several times, or are broken or thick, of course fresh baths have to be prepared and the old ones cleaned out.—*Textile Manufacturer.*

Desiccated Eggs.

It is already well understood that if albumen or white of egg be slowly dried in mass, or be dried rapidly at too high a temperature, a product or material will be the result which is of inferior and not uniform character or quality. Also, that if the yolk of eggs be dried in mass, slowly or rapidly, the result will be a material or product inferior in quality, not uniform in structure, difficult of solution, and of little value for the ordinary uses of the yolk of eggs. If batter of eggs composed of the whites and yolks together be dried in mass, the result lacks uniformity and solubility; and if either of these products, so obtained, be subsequently ground or pulverized, by any known process, the mealy result so obtained is of inferior quality, is slow of solution in water, and does not possess several of the important properties of the fresh shell eggs.

To meet this difficulty, the idea of the desiccation of eggs in rotation or agitation under blasts of air, either heated or otherwise, has been variously applied during a long time past, both in this country and in Europe, but the difficulty mainly encountered has been that of producing a material capable of being preserved in different climates, of being readily and completely dissolved, and of being applied to the principal uses and purposes for which the egg may be applied before desiccation.

The natural egg contains, in varying proportions, a certain oil, hereinafter spoken of as the oil of the egg. This oil is a very important constituent of the egg. It is innocuous while in its natural condition—that is, in undisturbed combination with, or relation to, the other parts of the organism of the egg, its proportion thereto being relatively small.

When, however, this oil is set free by any process, it rapidly becomes rancid, highly offensive, and, in fact, acrid, and is a most potent and active agent in effecting the deterioration and decomposition of the other parts of the egg with which it may be brought in contact.

If, during the process of desiccation, the material to be desiccated is allowed to rise in temperature above a certain point, hereinafter indicated, the oil of the egg contained in the more solid parts, or which is not in suspension or emulsion, but is in more perfect combination with the other constituents of the egg, particularly that in the yolk, and so in the batter composed in the yolks and whites, is set free to a greater or less extent, according to the freshness and vitality of the eggs used and the degree of such heat. It has also been ascertained, by experiment, that the temperature at which this result follows varies at different times. The causes apparently depend upon barometric and other conditions of the atmosphere as well as the state of the thermometer. Such a result has usually followed whenever the material has been raised above 85° Fah. The highest temperature to which Mr. W. O. Stoddard, of New York city, who has made a special study of this subject, has been able to subject the material without that result following was 92° Fah.; but that was under exceptional atmospheric conditions, and he considers a much lower temperature than 85°, and, if possible, than 80°, very desirable for safety, and essential to commercial success in the manufacture. Indeed, his own operations have been conducted at a temperature not to exceed 80°.

Mr. Stoddard has lately patented (May 8, 1877) a device, the object of which is to regulate and control the temperature of the eggs, or parts of eggs, or batter of eggs, or other material during the process of desiccation, so as to prevent the development or freeing from the more solid part of such material of the oil of the egg not held in suspension or emulsion, being much the larger part of all the oil contained in the egg, and afterward to eliminate from the product derived such small portions of the oil of the egg as may have been held in suspension or emulsion, or may have been set free in the process of manufacture. The granulated or mealy product which thus obtained will then, he claims, retain and protect its proper proportion of the oil of the egg, even if exposed to a much higher temperature than that above mentioned.

To obtain the object thus substantially set forth while employing for the process of desiccation a drying blast of warm air, he employs for the rotating surface, on which such desiccation is produced, a hollow cylinder, cone, frustum of a cone, or other surface which may be artificially cooled by means of ventilation or evaporation in the interior while the material within is actively agitated.

Employment of a New Salt of Iron for Stealing Copper Plates for Engraving.

The electrolytic deposit of iron on copper presents—as the author has shown thirty years ago—a great hardness, which equals at least that of steel. The salt generally employed for producing this deposit is double sulphate of iron and ammonia. The following solution seems to be more advantageous for this operation: We dissolve 155 grains of ferrocyanide of potassium and $\frac{1}{2}$ oz. of salt of seignette in 7 ozs. of distilled water, and we add to it 45 grains of ferric sulphate, dissolved in $1\frac{1}{2}$ ozs. of water; a precipitate of Prussian blue is thus produced. We add then, drop by drop, whilst stirring, caustic soda, until the precipitate is redissolved. We thus obtain a limpid yellowish solution, which is used for stealing copper. This same solution may serve to dye tissues blue without a mordant. For this purpose, after their immersion in the bath, we let them dry in the air; then we plunge them into a solution of sulphuric acid at 2°; we wash and dry them.—*M. R. Boettinger, in Chemisches Centralblatt.*

Wool Bleaching.

It has been found that the method of bleaching wool by means of oxalic acid, combined with glycerin, or used alone, has the effect of causing the fibers of the wool to become felted. This is now remedied by saturating the oxalic acid with soda, potash, or ammonia, thus forming a soluble oxalate. The bleaching is effected in the same manner, that is to say, with pure water, exempt from lime, and the wool preserves all its suppleness and soft touch.

Fast Railway Trains.

The New York Central and Hudson River Railroads and the Pennsylvania Railroad are now running fast trains between New York city and Chicago. The time allowed is about 24½ hours, the distance about 980 miles in each case. Taking these figures as a basis, a speed of 40 miles an hour, including stoppages, has to be maintained. The Chicago *Inter-Ocean* hints this speed is too great for safety, and asserts that passengers prefer to go by slower and safer trains.

JOHN W. EVANHART, of Marion county, Va., chopped down a chestnut tree the other day that contained 31 gallons of nice honey a distance of 10 feet from the butt. He afterwards made 600 rails and 1,000 shingles out of the tree.

PARA-ARABIN.—Professor E. Reichardt says that this substance, $C_{12}H_{22}O_{11}$, is obtained from the tissues of the sugar beet or the carrot after the juice has been expressed. It gelatinizes with water, and dissolves completely on the addition of a little acid and the application of a gentle heat.

London Water Pipes.

The first instance on record of water being conveyed to the city of London by means of pipes is in the year 1236. Before this time, according to Maitland, the city and places adjacent were supplied by the "river of wells," in the west part; whose decay was owing to certain mills erected on the banks thereof by the Knights of St. John, which obstructed its navigation, and by degrees gave it the name of Turnmill Brook, a name which is still preserved in Turnmill street, through part of which this water took its course towards the bottom of Holborn Hill, and thence into the Thames between the Fleet and St. Bride's. In process of time, Turnmill Brook was lost in the name of Fleet Ditch, or Fleet Dyke.

The other waters were Olborn or Holborn, Wall Brook, and Langbourn. Besides these bourns or brooks were several springs which supplied the city, as Holywell, a fine spring famed for its miraculous virtues in superstitious times; Clerk's or Clerkenwell, Skinner's Well, Fogg's Well, Tod's Well, Loder's Well, Crowder's Well, and Rad-Well, and the Horsepool or Horsepond in Smithfield. These several springs, or most of them united their streams, and formed the "river of wells" before mentioned.

In the year 1236, in consequence of a great want of water prevailing in London, occasioned principally by the encroachment of buildings and the Mills of the Knights of St. John, before referred to, on the fresh water canals about the outskirts of the city, many opulent citizens contributed liberally to the inauguration of a scheme for bringing water by means of main pipes from six fountains in the neighboring town of Tyburn, and this product was eventually carried into execution.

Hugh Myddelton, a worthy and enterprising citizen, carrying on the business of a goldsmith, who, after several others had attempted it without success, put into execution the design of supplying London with water for domestic use, by means of a river cut through the country from Chadwell and Amwell, near Ware, in Hertfordshire, to a basin or reservoir near Islington, on the north side of London. This work was begun on February 20, 1608, "and with great difficulty, art, and industry, and a prodigious expense," with the assistance of King James I., was completed, and the water let into it, on Michaelmas day, 1613. The source of the New River is twenty miles from London, but the measurement of the original stream, followed throughout its devious windings, necessary to preserve its level, and to some extent, also, owing to the stubborn opposition of certain of the landed proprietors, was 48 miles 3 quarters and 16 poles. Its length has been reduced, at different times, to about 28 miles, by cutting off the loops. On the completion of the work, Mr. Myddelton was knighted, and afterwards created a baronet. The stupendous undertaking eventually produced immense profits to the fortunate proprietors of its shares, but the original projector was all but ruined by the expenses he incurred in bringing it to a conclusion.

The successful completion of the New River marked an era in the history of the science of engineering in England; and the abundant supply of one of the chief necessities of life, which it afforded to the population of the metropolis, led to the development of the method of conveying water by means of pipes to the doors and into the dwellings of the inhabitants.

The main pipes used at that early day were sheet lead, turned on a mandrel, and soldered at the edges, and the trunks of elm trees, bored with augers, and left in their natural undressed condition outside. Other water companies were established in the course of time, till at the present day there are eight of these supplying London from various sources.

Gas began to be supplied through pipes in 1807.

French Workmen at the Exposition.

Ten thousand dollars have been appropriated by the Commissioners of the Paris Exposition of 1878 in aid of artisans who have meritorious objects to exhibit, constructed by their own hands, and who are working for their own account, but who are unable to defray the expense of exhibition from their own resources. The prefects of each of the 86 departments are to supervise the applications under this head.

THE royal tigress in the Berlin Zoological Gardens lately brought forth a litter of two, which she utterly refused to take care of. They were accordingly placed amidst the family of a Newfoundland dog, who welcomed the newcomers warmly, and bestows upon them all necessary maternal attentions.

DECISIONS OF THE COURTS.

United States Circuit Court—Northern District of Illinois.

TRUNK PATENT.—HERMAN VOGELER vs. EDWARD SEMPLE.
[In equity.—Before Blodgett, J.]

The claim in a patent must be for something described in the specification, so that any person of ordinary mechanical skill, or skill in the art covered by the patent, can, from the specification, make a mechanism which will contain the claim.

The purpose of a release is to enable one to secure what he was entitled to in his original patent, but, through inadvertence or mistake, did not obtain; but it cannot be made the means of covering anything which was not in the original invention.

The novelty of a patented invention is not impeached by a prior patent which did not originally describe the invention, but has since been enlarged by release so as to include it.

Any device which secures substantially the same results as the patentees by the same or equivalent mechanism, is an infringement.

This is a bill in equity for an injunction, and an account of profits and damages for an alleged infringement of a patent granted by the United States to the complainant, January 11, 1867, for an "Improvement in Trunks," being a release of an original patent to the same substantial purpose, dated October 6, 1874.

The answer denies the infringement, and also denies that complainant is the original and first inventor of the device set forth and claimed as new in his original and released patent.

Complainant's patent is for a removably hinged tray in the body of a trunk; the parts being so arranged and combined as to admit of the ready removal of the tray from the trunk, and yet so adjusted as to allow the tray to be turned up on its hinges, into, or against, the cover or top. This is accomplished by the peculiar form of the hinge—one leaf of which is permanently fastened to the tray, and the other so arranged as to be inserted in sockets, which are firmly fixed to the back wall of the trunk; the whole being so arranged as to admit of its up-and-down play.

The Court held that any device which secures substantially the same results as complainant's, by the same or equivalent mechanism, is an infringement on complainant's patent. The defendant does not use Vogel's strap hinge and socket, but in place of it he uses a hook and socket, or roller and socket—not the pin and socket of Plumer, but a hook attached to the back wall of the trunk, and a roller fastened to the back and upper edge of the tray, so as to engage with and rest upon the hook, the two when in juxtaposition making a hinge which performs the substantial functions of complainant's hinge, except that for lack of the elongated strap it is more readily disengaged; but when the parts are together, it operates in all essential particulars as the equivalent of complainant's strap hinge. I am, therefore, of opinion that defendant's tray is, in all its material features as a removably hinged tray, an infringement of complainant's patent.

Decree for the complainant.
[Monday and Forster, for complainant.
N. C. Gridley, for defendant.]

NEW BOOKS AND PUBLICATIONS.

TROW'S NEW YORK CITY DIRECTORY, for the year ending May 1, 1878. Price, \$5.00. New York city: The Trow City Directory Company Publishers, 11 University Place.

This is the ninety-first volume of this standard publication. It contains, we are told in the preface, 24,000 names, showing an increase of 7,233 over last year, and (estimating each name to represent five persons) an advance in population of the metropolis of 37,515. The work has been carefully compiled; and large as it is, equalling in printed matter, the publishers say some thirty volumes of the ordinary novel, has been entirely prepared and published since the 1st of May. The usual excellent map of the city is provided; and in general the work is fully up to its normal standard of excellence.

THE AMERICAN MAIL.—This is the title of a new and handsomely printed monthly publication devoted to trade purposes, especially designed for foreign circulation. It exhibits the latest quotations in all the different branches of trade, shows productions of the country, its manufactures, and the advantages which the American market affords in the way of supplies for foreign places.

Recent American and Foreign Patents.

Notice to Patentees.

Inventors who are desirous of disposing of their patents would find it greatly to their advantage to have them illustrated in the SCIENTIFIC AMERICAN. We are prepared to get up first-class WOOD ENGRAVINGS of inventions of merit, and publish them in the SCIENTIFIC AMERICAN on very reasonable terms.

We shall be pleased to make estimates as to cost of engravings on receipt of photographs, sketches, or copies of patents. After publication, the cuts become the property of the person ordering them, and will be found of value for circulars and for publication in other papers.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED MORTISING MACHINE.

Alfred D. Eddy and Henry J. Stolzenbach, Tiffin, O.—This invention is an improvement in that class of mortising machines in which the boring and cutting tool is caused to advance as the table carrying the stuff to be mortised is reciprocated in a direction at right angles thereto. The improvement relates to the device for clamping the stuff upon the table; the circular form of the work table, the adjustable bracket on which the worktable slides, the means for reciprocating the mandrel, the construction of the cam periphery, and a belt-tightening device.

IMPROVED APPARATUS FOR ATTACHING HARNESS TO THE SHAFTS.

William C. Smith, New Haven, Conn.—This is intended for the purpose of hitching quickly a single horse to any vehicle having shafts, or for hitching a double team, using two pairs of shafts, instead of a pole, the object of the device being to save time, so as to be specially adapted for horse carts, fire engines, and similar apparatus. It consists of a socket, with open top and spring-acted locking dog, applied to the harness, and of a button that enters the socket and is connected by loosely swinging link and trace piece to the shaft and trace.

IMPROVED RUNNING GEAR.

Moses Atwood, New Sharon, Iowa.—This running gear is so constructed that either of the wheels may rise above or sink below a level in passing over obstructions or depressions without straining the gearing or body.

IMPROVED SAWING MACHINE.

Flavel Simonson, Round Grove, Ill.—The operation of the machine is as follows: The guide is raised by a handle until it is engaged by a catch. A log is placed against the serrated plates and securely clamped by the dog by drawing a lever, the said lever being held in place by a ratchet bar. The guide is now released from the catch, and lowered until the saw comes into contact with the log, when, being in motion, it cuts its way through the log, being forced downward by the weight of the saw frame. When the log is cut through, the guide prevents it from dropping too low.

NEW HOUSEHOLD INVENTIONS.

IMPROVED INVALID BEDSTEAD.

Charles T. Moore, Renovo, Pa.—This is a bedstead for invalids which can be adjusted in various positions for the convenience and comfort of the occupant.

IMPROVED BURGLAR ALARM.

Hiram J. D. Miner and Daniel T. Seeley, Dunkirk, N. Y.—This is an alarm for attachment to doors and windows, which will indicate the opening of the same by releasing a spring-actuated train of gearing, which rings a bell. The movement of a lever attached to the door or window liberates an arm, and permits the gearing to act on the pallets and vibrate the hammer, which strikes a stud, causing the bell to ring.

IMPROVED WINDOW CORNICE.

Samuel Sargeant, Brooklyn, N. Y.—This consists in an improved window cornice, formed by attaching horizontal metal tubes and vertical metal tubes halved to each other, and provided with knobs in some or all of their ends, to foundation boards by screws passing through the said boards, through the inner sides of the said tubes, and into blocks of wood driven into the tubes.

NEW MISCELLANEOUS INVENTIONS.

IMPROVED ICE PLOW.

John F. Behm, Omaha, Neb.—This is an improved ice plow by which two furrows may be cut, and which may be used in either direction without turning the plow, the same marking also closer or wider, as required. The plow has cross-pieces, to which two longitudinal rows of

cutters are attached, that are arranged symmetrically to a center cutter, and decreasing in height toward the end cutters. The handles are attached to a centrally pivoted beam that may be swung around to use the plow in either direction without turning the same.

IMPROVED TOY MONEY BOX.

Edward J. McLoughlin, New York city.—The shaft of a winged wheel extends through the side of the bank, and is provided with a flexible index, which touches a circular row of pins that project from the face of a dial at the front of the bank. The coin is dropped into a chute, whence it passes to the wheel, and by striking one of its wings causes it to rotate. This motion continues until arrested by the friction of the journals and the resistance of the index as it passes the pins. A number is called, and if the index stops at the number mentioned the bank pays five times the amount of the deposit, which is retained, but if the index stops at any other number than the one called, the bank retains the deposit and pays nothing.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED GOVERNOR FOR STEAM ENGINES.

Harris Tabor, Corning, N. Y., assignor to B. W. Payne & Son, of same place.—This is an improved governor for steam engines, which acts in the customary manner when applied to an engine with single valves, and also as an automatic cut-off. When the speed increases over that required by the tension spring, weights are thrown out by centrifugal force, and the eccentric moved across the shaft, thereby reducing the travel of the valve until the engine is brought back to its former speed. If there is a tendency to decrease the speed the spring draws the eccentric in opposite direction, so as to impart a longer stroke to the valve and re-establish the required speed. The joint action of the tension spring and weighted levers on the sliding eccentric serves to keep up the uniform motion of the engine, according to the degree of speed to which the spring has been adjusted.

IMPROVED HEATING FURNACE.

Stephen W. Morgan, Winona, Minn.—This furnace saves fuel by means of reheating the smoke and passing the same again through a series of radiating pipes or drum. The invention consists, mainly, of a fire box with a system of horizontal pipes extending therefrom, and returning to a reheating box placed centrally in the fire, the gases of combustion being there reheated and conducted through a second system of heating pipes, and finally out to the chimney.

IMPROVED SAFETY VALVE.

Frank B. Scovell, Waterford, Ontario, Canada.—The steam is admitted to the space in a cylinder above a piston. The said piston being greater in area than the valve, the counter pressure exerted on it is more than sufficient to hold the valve to its seat. When the pressure of steam rises above the prescribed limit, a piston in the valve is forced upward against the pressure of a spring carrying a small sliding valve with it, so that it covers ports. The steam above the piston is thus permitted to escape when the valve is raised by pressure of steam from below, and steam escapes from the boiler until the normal pressure is regained, when the spring throws the small piston downward, moving the sliding valve, admitting steam to the space in the cylinder above the piston, when the steam so admitted will force down the piston, and cause the valve to regain its seat.

IMPROVED MACHINE FOR SANDING BRICK MOULDS.

Samuel W. Babcock, Haverstraw, N. Y.—To a shaft are attached rows of paddles, the different rows being set at a different lateral inclination. The shaft is revolved by a belt passing around a pulley attached to its end, and as it revolves the paddles take the sand from a box and project it through the slotted top of the table into the inverted moulds standing upon said table beneath the platform. A hopper having its bottom inclined from the middle to a hole on each side is connected by spouts with the apertured sand box, to enable the sand to flow automatically from the former into the latter.

IMPROVED TOOL HANDLE.

Levi H. Roberts, Morley, Mich.—The end of the handle is cut off about half an inch within the eye of the tool, and in the part of the said handle that enters the said eye is formed a transverse mortise, in which is loosely fitted a nut. In the end of the handle is bored a longitudinal hole to receive the bolt, the forward end of which is made conical. A plate, made a little larger than the eye of the tool, is rabbeted upon its inner side, to allow its middle part to enter said eye, and upon its inner side and upon the opposite sides of the hole for the bolt are formed two wedges. Slits are sawed in the end of the handle to receive the wedges. To the bolt is secured a collar. This arrangement allows the bolts to be started a little before it begins to withdraw the plate and wedges, so that should the said plate and wedges stick, they may be started by means of a chisel, or other suitable instrument.

IMPROVED MARINE ENGINE GOVERNOR.

William A. Brice, London, England.—This is an improved means of governing the speed of marine engines, to prevent what is known as "racing," when the screw is momentarily raised out of the water. The device consists in a centrifugal governor, of any suitable construction, driven by toothed gear direct from the screw shaft, and operating a throttle valve of any kind in one of two steam pipes, by which steam is supplied to the engines. Where one pipe has been used before to convey steam from the boiler to the engines, two pipes are used, and in one of them is applied a valve operated by the governor, as above described, so that immediately the screw commences to turn at a higher speed the valve will be closed, and the steam cut off through that pipe. If the sectional areas of the two pipes be equal, half the steam supply is thus cut off, the other half through the other pipe being intended to keep the engines in motion at the same speed.

NEW AGRICULTURAL INVENTIONS.

IMPROVED RECIPROCATING CHURN.

Eliza Brough, Greenville, Mich.—By suitable construction, as the churn body is oscillated upon its pivots, the milk is dashed back and forth, and is thrown into violent agitation, bringing the butter in a short time.

IMPROVED CATTLE STALL.

Ephraim E. Waddell, Gallipolis, O.—This consists in the combination, in a cow stable, of a frame, pivoted side gates, cross beam, and floor steps, the gates being pivoted in cross beam and steps, and between the front and rear ends of the stalls.

IMPROVED PLOW.

John D. Bowen, Roseburg, Oregon.—The invention consists in a share land-side and hand-side share made in one piece, cut out of sheet steel struck up into proper shape, or cast of cast steel, and provided with lugs and a slot for the attachment of other parts of the plow. The whole may thus be made of less material, lighter, and cheaper, the shares being self-sharpeners.

IMPROVED MOWER.

James H. Cain, Cana, N. C.—When the cutter blades are thrown into downward position by the lever, they are rigidly braced by a rod and retained in position for work by a hook, binding on a lever, so as to be operated by the reciprocating motion of the cutter bar as imparted by the gearing of the wave wheel with the main wheel. The swinging up of the cutter blades interrupts the gear of main wheel and wave wheel by joint action of levers, and gives, in this manner, to the attendant a full control over the mower.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion. If the Notice exceeds four lines, One Dollar and a Half per line will be charged.

Pattern Makers can get Metallic Pattern Letters, to letter patterns, of H. W. Knight, Seneca Falls, N. Y.

Wanted—Quantity large coiled Springs. Miller, Barlow & Co., Cookshire, Quebec, Canada.

West's New Yankee Tire Selter. Sets them cold on the wheel. Shrinks all around alike. J. B. West, Rochester, N. Y.

Wanted—A new 50 horse Engine and Boiler. Engine of latest style. Combining simplicity and economy. Enquire of A. M. Johnston & Co., Rockford, Ill.

Manufacturers of Felt Paper send samples and prices, by quantity, to S. T. Carr, Elmira, N. Y.

For Sale.—One Spinning Lathes. Good as new. Address White Sewing Machine Co., Cleveland, O.

Wanted—Burglar Alarm. Box 111, Saratoga Sp's, N.Y.

One third-class Amoskeag Steam Fire Engine built to order and highly finished, to be drawn by hand or horse, fully equipped with hose carriage, hose, pipe, and tools; engine was never in service, and can be seen at Rhode Island Locomotive Works, Providence, R. I.

Inventors.—All patents not received before June 25th must hold over until September Sale. G. W. Keeler, Auctioneer. See Advt.

A Device for Preventing the Accumulation of Frost and Steam upon Store Windows has been patented by C. T. Anthony and J. Manheim, of Taunton, Mass., to whom all letters should be addressed. Territory for sale.

Reliable Oak Leather and Rubber Belting. A specialty of Belting for high speed and hard work. Charles W. Army, Manufacturer, Phila., Pa. Send for price lists.

How to make Violins—Write J. Ranger, Syracuse, N.Y.

Shaw's Noise-Quitting Nozzles, for Escape Pipes of Locomotives, Steamboats, etc. Quits all the noise of high pressure escaping steam without any detriment whatever. T. Shaw, 915 Ridge Ave., Philadelphia, Pa.

For 13, 15, 16, and 18 in. Swing Screw-Cutting Engine Lathes, address Star Tool Company, Providence, R. I.

For Sale.—Second-hand 4 Sided-Moulder, with about 500 knives; good as new; price \$500. T. R. Bailey, Art., Lockport, N. Y.

Combined Miller and Gear-Cutter; capacity large; almost new; a bargain. C. A. Conde & Co., Phila., Pa.

For Boult's Paneling, Moulding, and Dovetailing Machine, and other wood working machinery, address B. C. Machinery Co., Battle Creek, Mich.

John T. Noye & Son, Buffalo, N. Y., are Manufacturers of Burr Mill Stones and Flour Mill Machinery of all kinds, and dealers in Dufour & Co.'s Bolting Cloth. Send for large illustrated catalogue.

Steel and Iron Set Screws, manufactured by L. F. Standish & Son, New Haven, Conn.

Electric Gas Lighting Apparatus, applied to public and private buildings. The latest improvements. A. L. Bogart's patent. Address 702 Broadway, N. Y.

Patent Taper Sleeve Fastening and Wooden Pulley Works are now in full operation. Orders solicited. Satisfaction guaranteed. A. H. Gray, Erie, Pa.

Painters, etc., get circular, prices, etc., of New Metal-lic "Wiping out" Graining Tools; 7,000 now in use. J. J. Callow, Cleveland, O.

Removal.—Fitch & Meserole, Manufacturers of Electrical Apparatus, and Bradley's Patent Naked Wire Helices, have removed to 43 Cortlandt St., N. Y. Experimental work.

Power & Foot Presses, Ferracute Co., Bridgeton, N. J.

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

Lead Pipe, Sheet Lead, Bar Lead, and Gas Pipe. Send for prices. Bailey, Farrell & Co., Pittsburgh, Pa.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing metals. E. Lyon & Co., 470 Grand St., N. Y.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 39 Park Row, N. Y.

Steel Castings from one lb. to five thousand lbs. Invaluable for strength and durability. Circulars free. Pittsburgh Steel Casting Co., Pittsburgh, Pa.

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

Small Fine Gray Iron Castings a specialty. Warranted soft and true to patterns. A. Winterburn, 16 and 18 De Witt St., Albany, N. Y.

Silver Solder and small Tubing. John Holland, Cincinnati, Manufacturer of Gold Pens and Pencil Cases.

Patent Scroll and Band Saws. Best and cheapest in use. Cordesman, Egan & Co., Cincinnati, O.

Best Glass Oilers. Cody & Ruthven, Cincinnati, O.

Diamond Saws. J. Dickinson, 64 Nassau St., N. Y.

Chester Steel Castings Co., make castings for heavy gearing, and Hydraulic Cylinders where great strength is required. See their advertisement, page 414.

Help for the weak, nervous, and debilitated. Chronic and painful diseases cured without medicine. Pulvermacher's Electric Belts are the desideratum. Book, with full particulars, mailed free. Address Pulvermacher Galvanic Co., 292 Vine St., Cincinnati, Ohio.

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

Oral and Disk Cutting Machines for Lithographers, Printers, Paper Box Makers, etc. Send for illustrated circular. Frank Thomas & Co., Home St., Cincinnati, O.

Reliable information given on all subjects relating to Mechanics, Hydraulics, Pneumatics, Steam Engines, and Boilers, by A. F. Nagle, M. E., Providence, R. I.



S. S. will find something on desiccating eggs on another page of this issue.—J. T. W. will find a

recipe for aquarium cement on p. 80, vol. 31.—J. P. M., Jr., will find on p. 133, vol. 29, directions for making a storm glass.—Mrs. J. G. B. is informed that galvanized pipes and vessels are very deleterious to water. See p. 139, vol. 33.—R. W. S. will find something on regulating the heat of an incubator on p. 273, vol. 33, and p. 213, vol. 34.—A. R. S. should read the answer on p. 390, vol. 35, as to moulding in plaster of Paris. As to cleaning carpets, see p. 89, vol. 25.—P. M. B. will find on p. 385, vol. 35, directions for removing oil stains from granite.—J. E. M. will find directions for bluing steel on p. 133, vol. 31.—D. H. B., of Aby-Thorslag, Sweden, is informed that we do not know the address for which he inquires.—L. B. will find the description of high and low pressure engines on p. 42, vol. 25. As to the rule for horse power, see p. 33, vol. 33.—B. Y. can try the preparation described on p. 154, vol. 32, to preserve his silver objects from being tarnished.

(1) C. W. B. asks: 1. How can I make hair rope fireproof? A. Strong, warm solutions of tungstate of soda (crude), or of sulphate of soda (Glauber salt), in water may be used for this purpose. It is not necessary to repeat the tungstate of soda treatment unless the material has been exposed to continued wet weather, in which case it is recommended to precipitate the insoluble tungstic acid in the fiber by soaking it, after impregnation, in diluted muriatic acid. The sodium chloride (salt) formed should be dissolved out with warm water. For hair ropes, it would be best to pass the material through a bath of warm alkali before impregnating with the tungstate. 2. Does the process make it heat-proof? A. We do not know what is meant by "heat-proof." Impregnating the ropes with inorganic salts will much alter its heat conductivity.

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

O. B.—No. 1 is not a lithographic stone, and would be of little value for lithographic purposes. It might answer for rubbing down rough metal, and in marble polishing. It is too soft and porous to make a good hone. No. 2 is a limestone; and if properly burnt, it might make a cement.—D. E. W.—The mineral contains (besides carbonate of lime) crystals of barite and celestine. You should send a larger piece.

A. I. asks: Has there been anything invented to throw a paddle wheel off of its center? Many such wheels, and stationary engines also, stop in the dead center, and have to be pried off before they can start again.—W. G. B. asks: How is the low temperature produced and maintained in the refrigerators on exhibition at the Centennial? I noticed that the thermometers in them showed about 20° Fahr.—C. L. P. asks: Will C. H. S., who uses coal oil to make his hair grow, inform me how he applied the oil, how often, and how much at one time, and whether he washed or bathed his head with water?

COMMUNICATIONS RECEIVED.

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

On a New Motor. By W. B. M.
On Steam Economy. By J. W. T.
On Torpedo Balloons. By T. F.
On a Fire Escape. By W. C. M.
Also inquiries and answers from the following:
J. D. H.—F. J. B.—J. B. M.—W. H.—J. B. B.—G. G.
J. H. W.—A. A. A.—H. S.—G. F. K.—J. B.—C. A. S.

HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Inquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of inquiries analogous to the following are sent: "Who sells the best boiler scale preventive? Who makes imitation marble? Who sells glazed porcelain tiles? Who sells iron stable fittings? Who sells aquaria, with fish, reptiles, and suitable plants? Who sells astronomical telescopes?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

OFFICIAL.

INDEX OF INVENTIONS

FOR WHICH
Letters Patent of the United States were
Granted in the Week Ending
May 22, 1877,
AND EACH BEARING THAT DATE.

[Those marked (r) are renewed patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

Agricultural cooker, Farley & Blackwood 191,127
Alum, etc., making, C. Lemig 191,129
Animal trap, P. A. Herbert 191,032
Apple parer, W. M. Griscom 191,138
Auger, hollow, C. S. Bonney (r) 7,699
Bag machine, E. Stanley 191,013
Baker, L. Drew 191,035
Baking pan, Kagey & Stoneburner 191,059
Bale tie, wire, L. Stewart 191,122
Bedstead, invalid, C. T. Moore 191,063
Bedstead, wardrobe, R. Cleveland 191,067
Beeswax, bleaching, H. T. Yarran 190,995
Blacking box, J. H. Weeks 190,992
Blind slats, compressing ends of, E. Cather 191,111
Boiler and steam heater, G. W. Blake 190,945

Boiler flue brush, J. H. Davis 190,930
Boiler, sectional, B. H. Graham 190,966
Boot soles, nailing, L. Goddu (r) 7,692
Bottle opener, E. Bacher 191,030
Bracelet, Hammond & Krymer 191,140
Breech loading fire arm, E. Engel 191,124
Breech loading fire arm, F. W. Tiesing 191,197
Brick moulds, sanding, S. W. Babcock 191,018
Bridle bit, W. M. Hutton 190,969
Broom winding machine, J. Gray 191,048
Brush machine, J. D. Baker 190,999
Buckle, trace, W. B. Walker 191,014
Bung cutting machine, P. Medart 191,026
Bureau drawer, I. Mason 191,162
Burglar alarm, W. J. Decker 190,961
Burglar alarm, Miner & Sealey 191,057
Butter mould, S. Giles 191,045
Camp stool, E. M. Sammis 191,182
Can opener, R. H. Rose 191,075
Canal boats, propelling, B. H. Muehle 190,975
Car axle box, R. B. Eason 191,037
Car coupling, Dobbs & Robinson 191,122
Car coupling, S. N. Keith 191,000
Car coupling, J. D. Ross 190,984
Car coupling, G. W. Wilson 190,214
Car heater, E. O. Huntington 191,066
Car sleeping berth, A. E. Barthel 191,099
Car window, Barker & Shill 191,095
Cardboard, ornamenting, Adams & Bott 190,997
Carpet stretcher, A. T. Safford 190,985
Carpet sweeper, E. T. Prindle 190,982
Carriage top, C. Fockler 191,129
Cattle stall, E. H. Waddell 191,096
Centrifugal machine, A. A. Goubert 191,137
Chair, J. Hess 190,967
Chair, folding, E. H. Mahoney 190,974
Chair, folding arm, W. A. Webb 191,015
Chandelier, adjustable, R. Marsh 191,064
Check register, Stewart & Van Heven 190,988
Check rower, etc., De Vaux & Rosser 191,035
Churn, reciprocating, A. Heartill 191,142
Churn, rotary, D. L. Westcott 191,219
Cigar, J. H. Campbell 191,108
Cigar box, A. E. Ebert 191,038
Clams, preserving, H. W. Butties 191,024
Clothes washer, J. W. Cheek 191,028
Clothes washer, A. Kimber 191,157
Coal hod, E. F. O'Toole 191,071
Cockeye and trace clip, J. W. Hoffman 191,143
Coffee-making apparatus, A. G. Burby 191,106
Coin, metal alloy for, W. W. Hubbell 191,146
Corn and seed planter, H. F. Baker 191,019
Corn planter, Miller & Wright (r) 7,696
Corn planter and drill, J. L. Hill 191,054
Cultivator, Brewster & Neher 191,101
Cultivator, Robertson & Knight 191,179
Cultivator, E. M. & M. L. Kiesel 190,972
Distillation, continuous, S. Van Syckel 191,208
Door fastener, C. R. Arnold 190,998
Draft equalizer, L. W. Frederick 191,041
Drawing metal rods, etc., Brankman & Brightman 191,100
Electric light, N. E. Reynier 191,177
Engine and pump donkey, J. Stannah 191,190
Engine, oscillating, Gibson & Eberhart 191,134
Engine, air pump connection, G. H. Corliss 190,968
Explosive compound, O. Burstenbinder 190,954
Eyeglass, F. P. Iannarone 191,149
Faucet, self-closing, H. C. Meyer (r) 7,694
Fence barb, A. J. Nellis 191,011
Fence barbs, wire, H. N. Frenness (r) 7,697
Fence, portable, A. S. Chaney 191,113
Filtering apparatus, J. Galey 191,131
Finger nail cutter, R. W. Stewart 190,999
Fire escape, A. L. Clark 191,115
Fire escape, Dart & Post 191,118
Fire escape, D. B. Ewing 191,125
Fire escape, E. Row 191,131
Fireproof ceiling, J. Gilbert 191,135
Fish hook, snap, G. C. Miller 191,165
Flower pot supporter, W. F. Sampson 191,183
Fluid meter, C. M. Van Tine 191,205
Fork table, L. S. White (r) 7,700
Fruit dryer, W. S. Plummer 191,072
Fruit jar, C. Hastings 191,050
Furnace, J. Jenkins 191,005
Furnace and hot blast oven, A. Wilson 191,213
Furnace grate, C. Deguine 191,032
Furnace, heating, S. W. Morgan 191,039
Furnace, metallurgical, W. M. Watson 191,209
Gage, F. K. Hesse 191,053
Gage for bits, R. Gardner 191,133
Game and cartridge belt, Case & Bedell 191,027
Game apparatus, F. E. Nutting 191,169
Garment holding device, C. E. Johnson 191,132
Gas apparatus, dip pipe for, J. Dittmar 191,121
Gas cocks, electric opening of, D. M. Smyth 191,012
Gas, manufacture of, M. H. Strong 191,082
Gate, Cherry & Elliott 191,114
Gate, I. D. Jewett 191,151
Gear wheel, D. Jones 191,155
Glass mould, shade, etc., H. Brooke 191,102
Glue, manufacturing, C. O. Garrison 191,132
Governor, marine engine, W. A. Brice 191,023
Governor, steam engine, H. Tabor 191,084
Grain and seed separator, C. A. Weed 190,991
Grain binder, W. R. Baker 190,996
Grain binder, S. D. Locke (r) 7,701
Grain binder, Werts & Gilmer 190,993
Grain separator, C. A. Weed 190,990
Grasshopper destroyer, J. V. Barger 191,077
Grate shelf, J. Boorum 190,951
Hammer, tack, F. B. Glasscock 191,136
Harness to shafts, attaching, W. C. Smith 191,081
Harness tug, C. Hauff 191,051
Harrow, sulky, G. M. Furman 191,043
Harvester cutter, A. Walter 191,207
Harvester lever, H. & H. L. Wells 191,087
Hat, F. P. Flanagan (r) 7,701
Hat, H. Kuhlman 191,051
Hay stacker, J. Chase 191,001
Hen's nest, H. B. Morrison 191,166
Hoisting gear, cattle, W. H. Axford 191,091
Horse hay rake, D. Martin 191,161
Horse hay rake, Smith & Cowles (r) 7,696
Horse power link, J. Westinghouse 191,211
Hose nozzle, E. R. Tomlinson 191,139
Hose couplings, attaching, D. T. Ellis 191,039
Hose to couplings, securing, J. A. Caldwell 191,026
Hot air register, L. E. Smith 191,080
Hydrocarbon burner, etc., C. Holland 191,144
Hydrocarbon vapor burner, B. W. Park 191,170
Ice plow, J. F. Behm 191,030
Infusions, making, R. U. Etzenberger 190,964
Inlaid work, designing, J. U. Mueller 191,167
Iron castings, hardening, J. A. Andrews 191,099
Key hole guard, C. Eisele 191,123
Kits and buckets, making, J. P. & S. N. Blood 191,099
Knife handle and sheath, Manuel & Whitehouse 191,063
Knitting machine, J. L. Branson 190,952
Knitting machine, J. Sibson 191,186
Ladle for metal founding, W. Fawcett 191,128
Lamp burner, B. Hempstead 191,141
Lamp, pneumatic, G. W. Cook 191,032
Latch for doors, etc., A. C. Woolman 191,216
Latch, gate, J. Neill 190,978
Lawn mower attachment, A. H. Wood 190,994
Leaf turner, D. W. G. Humphrey 191,065
Leather, cutting, etc., J. W. & R. H. Larkin 191,006
Leather, whitening, etc., W. A. Perkins 191,173
Lifting jack, T. J. & C. C. Case 191,110
Liquids, elevating, T. Hanson 191,040
Lock, alarm, G. W. Graham 191,046
Locks, face plate for, A. Stewart 191,191
Locomotive furnace door, W. W. Hubbell 191,147
Loom, stop motion, J. M. Linscott 191,062
Lubricator, C. H. Parshall 191,171
Magazine firearm, F. W. Tiesing 191,196
Milk cooler, E. D. Bennett 191,021
Milking stool, E. Avey 191,090
Mould board, conical, C. V. Dyer 191,096
Mortising machine, H. Carter 191,109
Mower, J. H. Cain 191,025
Mower, R. Dirks 190,992
Mower, W. N. Whiteley 191,016
Musical instrument, M. H. Collins 191,029
Napkin holder, M. Campbell 191,107
Napkin holder, R. W. Huston 191,148
Nut lock, Hahn & Mayers 191,139
Nut lock, E. R. Shepard 191,079
Nuts, making, S. S. Townsend 191,200
Oil can, J. Graves 191,047
Oil can spout, H. C. Campbell 191,000
Oil still, S. Van Syckel 191,204
Oven and oven door, W. C. Davis 191,119
Padlock, R. Thompson 191,195
Paint composition, C. Brown 190,953
Paper box, L. B. Plimpton 190,980
Paper box, L. B. Plimpton 190,981
Pasteboard blanks, cutting, A. Chase 191,112
Pavement, wood, H. M. Stow 191,194
Pen, E. S. Johnson 191,154
Pipe joint, A. W. Foster, Jr. 190,968
Pitman, O. Cooley 191,116
Pitman box, E. M. Krum 191,159
Plow, J. D. Bowen 191,022
Potato digger, D. M. Kink 190,971
Propeller guard, A. Marshall 191,097
Pump, J. F. & W. W. Furnas 191,044
Pump piston, J. M. Springer 191,183
Punching metal, A. Robertson 191,074
Radiator, steam, R. L. Kernochan 191,156
Radiators, air box for, G. W. Blake 190,950
Railway switch, C. L. Cooke (r) 7,699
Railway signal, circuit closer, H. N. Rowell 191,076
Refrigerator lining, G. H. Levis 191,073
Respiratory brace, G. F. French 191,042
Revolving firearm, C. H. Richardson 191,178
Rolling bars, etc., I. Reese 190,983
Roofing material, C. M. Warren 191,208
Running gear, M. Atwood 191,017
Sash holder, L. R. Witherell 191,215
Saw, circular, E. W. Tilton 191,198
Saw, jig, L. T. Stanley 191,199
Saws, sharpening, etc., S. Whitesides 191,212
Sawing shingles, T. H. Delaney 191,084
Sawing staves, A. Knipper 191,158
Seed planter, Bryant & Partridge 191,104
Sewing needles, straightening, Thompson & al 191,085
Sewing shuttle lever, R. H. St. John 191,198
Sewing machine stop, H. D. Baker 190,948
Sheet metal can machine, G. H. Perkins 191,172
Sheet metal, seaming, J. F. Starr, Jr. 190,987
Shelves, supporting, F. G. Johnson 191,058
Shutter worker, Buttler & Zwiendinger 191,105
Shutter worker, M. M. Zellers 190,996
Signal light, floating, R. Pintsch 190,979
Skylight lifter and lock, J. F. Wollensak 191,088
Slate frame attachment, K. F. Meyer 191,009
Soldering apparatus, S. Uhlich 191,202
Spark arrester, I. B. Smith 191,187
Spoon and fork, L. S. White (r) 7,699
Steam generator, J. & G. Firmenich 191,034
Steering, surge reliever for, R. M. Mountfort 191,070
Stone, drilling, F. Johnson 191,067
Stove pipe thimble, Selden & al 190,986
Stove polish, J. W. Hill 190,968
Straw cutter, T. E. Marnable 191,000
Street sweeper, N. Campbell 190,964
Sucker rod, L. Rogers 190,180
Sugar liquor, saving, F. O. Matthiessen 191,163
Suspenders, A. Shenfield 191,184
Syringe case, B. F. Sutton 191,083
Tablets, etc., making, H. Pfeil 191,174
Tag, E. Culver 191,117
Tamping tool, L. W. Mead 191,164
Telegraph, chemical, C. A. Randall 191,176
Telegraph system, T. M. Foote 191,130
Thill loop or supporter, T. Eaton, Jr. 190,963
Tires, etc., bending, L. W. Tyler 191,201
Tobacco cutter, J. Farrar 191,126
Tobacco pipe, B. Lorillard (r) 7,698
Tobacco pipes, moulding clay, J. G. Oliver 190,977
Tool handle, L. H. Roberts 190,973
Toy money box, E. J. McLoughlin 191,065
Toy pistol, C. A. Bailey 191,094
Toy skating rink, S. E. Bachmann 191,092
Toy, trundle, H. P. Pfum 190,978
Traveling bag, S. R. Raffel 191,175
Type writer, P. Deming 191,123
Valve, safety, F. B. Scovell 191,078
Vehicle spring, F. W. Faber 191,040
Vehicle spring, H. L. Isham 191,180
Velocipede, J. L. Hornig 191,145
Ventilator, C. E. Darling 191,033
Ventilator for grain, H. Y. Cahill 190,955
Wagon step, platform, C. Conderman 191,090
Water meter, J. H. Connell 191,081
Water wheel, W. T. Keaser 190,970
Windmill, J. Nesbitt 191,108
Window cornice, S. Sargeant 191,077
Window screen, J. C. Walker 191,206
Wire cutter, J. Johnson 191,183
Wrench, H. Davis 190,980
Wrench, J. P. Mitchell 191,010

DESIGNS PATENTED.

9,992—TYPES.—W. F. Capitain, Chicago, Ill.
9,993—CLOCK FRAME, ETC.—H. J. Davies, Brooklyn, N. Y.
9,994 to 9,997—CARPETS.—J. Hamer, Dutchess Co., N. Y.
9,998—RUGS.—J. Hamer, Dutchess county, N. Y.
9,999—CARPETS.—J. Hamer, Dutchess Co., N. Y.
10,000—PUMPS.—O. Heinigke, New York city.
10,001—SHOES.—G. W. Meader, Woonsocket, R. I.
10,002—CARPETS.—J. Neil, New York city.
10,003—LACE FABRIC.—J. Robinson, Brooklyn, N. Y.
10,004—CARD RACKS.—P. Rosenbach, New York city.
10,005—CARPET.—T. J. Stearns, Boston, Mass.
10,006—DIRECTORY BOARDS.—W. H. Thackeray, Pittsburgh, Pa.
10,007—METAL BOXES.—W. Wilkinson, Phila., Pa.
10,008—CANTERS.—A. H. Wirz, Philadelphia, Pa.
[A copy of any one of the above patents may be had by remitting one dollar to MUNN & Co., 37 Park Row, New York city.]

INDEX.

ILLUSTRATIONS.

- A**
- Aerhydric chain, Toselli's..... 322
 African habitations..... 247
 Air compressor, Guild and Garri-
 son's..... 311
 Air, supporting a ball on a blast of
 Ambulance, a new..... 151
 Ammonia soda process, the..... 405
 Angle, trisection of..... 36
 Aquarium for the Paris exposition
 Arctic expedition, the recent..... 34
 Asparagus in winter..... 87
 Axe, Rollins'..... 355
 Axle box, self-oiling, Tomlin-
 son's..... 54
- B**
- Bad Lands, the, Dakota Terri-
 tory..... 167
 Ballasting tube for vessels, Borg-
 hold's..... 405
 Bastille, the..... 215
 Boiler cleaner, Cronin's..... 130
 Boiler regulator, gas, Martin's..... 352
 Boiler tube leak stopper, McCon-
 nell's..... 230
 Bottle, perfume, Ward's..... 230
 Brick machine, rotary, Machen's..... 271
 Bridge, South st., Philadelphia..... 351
 Bridge, the East river-making
 the wire..... 127
 Bridge, the foot, over the East
 river..... 143
 Burner, Godefroy's..... 339
- C**
- Calculating machine, Grant's..... 294
 Caliper, a micrometer..... 9
 Calm muzzie, Miller's..... 386
 Capillary, Romilly's experi-
 ments in..... 306
 Capstan, steam, mining..... 4
 Carpet stretcher, Ballard's..... 131
 Cars, street..... 265
 Cat teaser, Topf's..... 39
 Cattle, prize English dairy..... 71
 Chemical magic..... 36
 Chimney, smoky..... 118
 Chuck, self-centering variety..... 406
 Church, ancient timber, in Nor-
 way..... 129
 Clocks, mysterious, Robert's..... 405
 Cockeye, harness, Knapp and
 Schallhorn's..... 113
 Coffee and sugar machinery..... 82
 Color from soap films, projecting
 Connecting rod, curve of a point
 on a..... 180
 Connecting rods, solid-ended..... 20
 Copying press, telegraph message
 Corn sheller, Goddard's..... 134
 Cow milker, Knollin's..... 230
 Cradle, bedstead, Robertson's..... 230
 Cremation temple, Lillenthal's..... 119
 Cut-off, variable, Fish's..... 169
- D**
- Dates in Ceylon, gathering..... 111
 Decorative bow, Sabate's..... 182
 Door knob screws, device for
 holding, May's..... 275
 Dredging machine, Davis's..... 50
 Drill, rock, Merzhon's..... 238
 Dumper, lightning, Willes and
 Rowe's..... 166
 Dumping scow, Allen's..... 166
 Duomo and Campanile, Florence..... 231
 Duplication of the cube..... 41
- E**
- Electric candle, Jablockhoff's..... 339
 Electro-static induction, Volpi-
 cell's experiments..... 401
 Elevator, grain, New York Cen-
 tral Railway's..... 390
 Elevator, pneumatic, Blanchet's..... 403
 Engine, agricultural, Frick &
 Co.'s..... 95
 Engine, automatic cut-off..... 66
 Engine, compound marine, Sells..... 22
 Engine, domestic steam, Landis's..... 262
 Engine, hydraulic, Richardson's..... 302
 Engine, hydrocarbon, Brayton's..... 302
 Engine, portable steam, Mills's..... 130
 Engine, rotary, Thomas's..... 405
 Experiment, a lecture..... 31
 Exposition of 1875, the French-
 The Trocadero..... 31
- F**
- Falence ware..... 103
 Fire alarm and bell pull, electric
 Gaulier's..... 294
 Fire escape, Houghton's..... 294
 Fire-extinguishing apparatus for
 vessels, Granger's..... 300
 Fish scale, Lawton's..... 300
 Flatulenta fabacaria..... 1
 Flight, mechanical, Tatin's ex-
 periments..... 179
 Fountain at Aranjuez..... 343
 Frame clamp, Wieting's..... 147
 Friction clutch, new..... 147
 Friction of slide valves, deter-
 mining, Dean's method..... 116
 Frost plant, the..... 338
 Fumigator, new..... 338
- G**
- Gardens of the Villa Medici, Rome..... 53
 Gauge, Stoner's..... 403
 Gauges..... 215
 Gecko, the fringed tree..... 36
 Glass bottles, cutting..... 146
 Glass-making, curiosities of..... 14
 Glass, tempered..... 14
 Gleichenia dicarpa..... 352
 Gorilla, the..... 63
 Grain sampler, Gent's..... 227
 Grinders, knife and stove plate,
 the Tait Co.'s..... 22
- H**
- Hare and her foes, the..... 23
 Harry eagle, the..... 135
 Hat and coat rack, Dorr's..... 96
 Hay fork, horse, Grant's..... 341
 Heart, the, Marcy's investiga-
 tions..... 51
 Heligamite, the..... 392
 Hem-plunger, Tomlinson's..... 115
- I**
- Hippopotamus dentistry..... 67
 Hoisting machines, friction,
 Mundy's..... 338
 Horse box, Fennell's..... 394
 How to do it, and how not to do it..... 309
 Hunted down..... 23
 Hygrometer, Hachenberg's..... 35
 Hygrometers, natural..... 67
- J**
- Ice cream freezer, Dexter's..... 6
 Ice fringes on plants..... 212
 Ice, traveling over the..... 34
 Injector for steam boilers, West-
 ley's..... 335
 Ironclad Duilio, Italian..... 370
 Ironclad Hamidieh, the Turkish..... 370
 Ironclad man-of-war Alexandra,
 the..... 253
- K**
- Kingfisher, a remarkable..... 311
- L**
- Lake dwellings, African..... 247
 Lathe, gap, Watson's..... 253
 Laughing jackass of Australia,
 the..... 311
 Leather-stamping machine, Ur-
 ber's..... 335
 Life preserver, Beck's..... 274
 Life-saving devices, Houghton's..... 274
 Lions, young, Central Park, New
 York..... 235
 Lithographic stone dresser, Per-
 son's..... 302
 Locomotive, traction of a..... 132
 Locusts of the West, the..... 210
 Lubricant tester, Deprez and Na-
 pol's..... 394
 Lubricant-testing apparatus,
 Thurston's..... 89
- M**
- Mammoth artificial, Martin's..... 407
 Marmoset, an interesting..... 407
 Measure, liquid, Wilkinson's..... 374
 Meat, export of American, to En-
 gland..... 273
 Microscope object finder, Bar-
 peen's..... 100
 Mill, grain, Straub & Co.'s..... 36
 Milling machine, Campbell's..... 332
 Money box, advertising, Brice's..... 134
 Motor deception, a new..... 179
 Moulding machine, upright..... 86
 Moulding machine, upright..... 86
 Mushrooms..... 194
- N**
- Navy, steam, Dunbar & Rus-
 ton's..... 399
 Nerve excitements, propaga-
 tion of..... 227
- O**
- Oreocephale, the marine..... 215
 Organs, old and new..... 242
 Ornithological deformities..... 98
- P**
- Paddle wheel, Williams'..... 374
 Palazzo Vecchio, the, Florence,
 Italy..... 231
 Palaeocystic sea, the..... 35
 Panther and her young..... 295
 Paper barrel mould, Hubbard's..... 339
 Paper box machinery..... 5
 Paper pulp distributor, Jennings'..... 339
 Paper pulp engine, Warren's..... 403
 Papyrus or paper reed, the..... 307
 Pavilion, a Persian..... 323
 Persia, temporary residence of
 the Shah..... 323
 Persian house, courtyard of a..... 183
 Peruvian antiquities in Paris..... 375
 Photographer's desk, Burrows
 and Colton's..... 236
 Phylloxera remedy - Decortica-
 tion..... 182
 Planks, the..... 370
 Pipe tongs, wrench and screw-
 driver, Slates & Cook's..... 310
 Pipe tools..... 371
 Planing and polishing machine,
 Norris'..... 386
 Pneumatic transmission in New
 York city..... 175
 Pompeii, its ruins, relics, etc..... 328
- Q**
- Power economy, Peters'..... 99
 Prickly conifer, the..... 71
 Puddling machine, Clough & Co.'s..... 15
 Pump bucket, adjustable chain,
 Kenyon's..... 310
 Pump, Little Giant, Hobaugh's..... 310
 Pump, rotary, Honyoux's..... 162
 Pump, the Selden..... 198
 Pumping engine, Louisville..... 35
 Punching machine, hydraulic, Hy-
 draulic Engineering Co.'s..... 102
- R**
- Rafflesia, the..... 87
 Rail joint and nut lock, Nichol's..... 354
 Railroad grader, Harden's..... 223
 Railroad, the West Mountain..... 114
 Railway, locomotive, hydraulic,
 Leaman and Heckart's..... 79
 Rat, the nerves of a..... 227
 Rat trap, Wildes'..... 194
 Rice in China, cultivating..... 194
 Rivets and riveting machinery..... 63
 Roots, the respiration of..... 70
 Rubber articles, making, Long-
 den's method..... 190
- S**
- Safes are blown open, how..... 244
 Safety valve tests..... 353
 Safety valves, Mellings'..... 99
 Sailing against the wind..... 368
 St. Peter's and the Vatican..... 55
 Saw, scroll, grinder and polisher,
 Tramp Bros..... 275
 Sawmill, portable gang, Marston's..... 113
 Screw-cutting lathe, English..... 113
 Screw-cutting tools, Wiley &
 Russell Co.'s..... 24
 Screw threads, remarkable..... 96
 Sea lions, Californian..... 343
 Sewage irrigation..... 332
 Sewage irrigation and purifi-
 cation, near Paris..... 367
 Shafting, to adjust line..... 306
 Shaft, water boiled in a..... 306
 Sieve, the manufacture of..... 277
 Silverware, the..... 284
 Slide valves, friction of..... 151
 Smelting furnace, a Kouy..... 151
- T**
- Targets for the 100 ton gun..... 150
 Telephone, A. Graham Bell's..... 191
 Telephone, Gray's..... 363
 Testing machine, Thurston's..... 342
 Toaster, bread, Harris'..... 99
 Torpedo, effect produced by a..... 246
 Torpedo experiments at Cher-
 bourg, France..... 239
 Torpedo launch, Thackeray's..... 246
 Torpedo warfare, Porter's sys-
 tem..... 129
 Torpedoes, making the Harvey,
 at Woolwich, England..... 402
 Trap, sewer, Adams'..... 236
 Trolley hook, Brush's..... 114
 Tube expander, Work's..... 66
 Tunnel, etc., Delaware and Lack-
 awanna Railway, Hoboken,
 N. J..... 319
- U**
- Valve, relief and safety stop,
 Wiggins'..... 351
 Vase, the Bryant..... 291
 Velocipede, new water, Jobert's..... 38
 Violins, wood for..... 100
 Vise, pipe, Exeter Machine
 Works..... 19
- W**
- Watch, Mattie's..... 342
 Water elevator, Wright's..... 274
 Who comes here?..... 63
 Wire, making, for the East river
 bridge..... 127
 Woodworking machines, Ar-
 bey's..... 210
 Writing, method of secret, Berg-
 hold's..... 406
- Y**
- Yardstick and measure, Some's..... 262
- MISCELLANY.**
- Figures preceded by a star (*) refer
 to illustrations.
- A**
- Academy of Sciences, New York..... 25
 Accident, bridge, at Ashtabula,
 Ohio..... 35
 Acids, organic and minerals..... 329
 Adirondacks, lithology of the..... 25
 Advertising, ingenious..... 23
 Aerhydric chain..... 322
 Aerial propulsion, new discov-
 eries..... 276
 Aeronautics..... 21, 276
 Air, compressed, for power..... 356
 Air compressor..... 310
 Air for combustion of coal..... 6
 Air contaminated by artificial il-
 lumination..... 213
 Air, pressure of, and temperature..... 41, 172
 Air suspended in water..... 246
 Alcohol and cold..... 33
 Alloy expanding in cooling..... 17
 Alloy for fine castings..... 157
 Alloys in U. S. coinage..... 6, 44
 Alum in bread, estimating..... 303
 Alum in bread, estimating..... 303
 Alum solutions, density of..... 130
 Amber, Roumanian..... 105
 Ambulance, a new..... 151
 Amusement of Science..... 303
 American industry..... 381
 Ammonia salts from gas liquor..... 199
 Anaesthetic, a new..... 152
 Andes and the Amazon, the..... 97
 Aniline black..... 296
 Aniline water colors..... 99
 Animals, geographical distribu-
 tion of..... 82
 Animals, the migrations and dis-
 persal of..... 65
 Animation in vegetables, sus-
 pended..... 80
 Annotto, extract of..... 371
 Answers to correspondents..... 11, 27, 44, 59, 73, 97, 123, 186, 196, 233, 219, 255, 290, 297, 298, 299, 315, 331, 347, 362, 379, 410
 Ant intelligence..... 198
 Antifriction metal, Belgian..... 235
 Antiquary inscription, valuable..... 66
 Apparatus, simple..... 361
 Apples, export of..... 7
 Architecture, city..... 145
 Arctic expedition, the recent..... 35
 Arctic navigation, a lesson in..... 177
 Armada, relics of the Spanish..... 38
 Arsenic from cobalt and nickel..... 217
 Asbestos, a new use for..... 192
 Ashtabula, the..... 37
 Asphalt tiles in winter..... 7
 Astronomical notes..... 9, 73, 183, 290, 341
 Astronomical notes for March..... 183
 some..... 345
 Astrophysics..... 357
 Augers, twisting..... 357
 Axe, a new..... 353
 Axle box, self-oiling..... 54
 Axle, greasing..... 391
- B**
- Babbitt metal boxes..... (1) 355
 Baby brutes..... 294
 Bad Lands of White River, the..... 167
 Ball on a blast of air..... 150
 Ballasting tube for vessels..... 405
 Balloons, varnishing..... 34
 Banian tree, the..... 401
 Barometer and the sea level..... 169
 Barometers, flower..... 399
 Barrels, stopping pores in..... 271
 Bathometer, a new..... 214
 Battery, a celebrated..... 84, 95, 182
 Battery, a simple..... 131
 Battery for alarm bells..... 250
 Battery, galvanic, in medicine..... 216
 Beavers in California..... 228
 Bee-keeping in the Himalayas..... 275
 Beer for starch sugar, testing..... 402
 Bees, a woman's success with..... 244
 Bees, management of..... 247
 Reef in England, American..... 72
 Bell metal..... 40
 Belle Isle, blooding the Straits of..... 148
 Berthollet's law..... 148
 Bichromate of potash, an anti-
 septic..... 296
 Binocular vision experiments..... 281
 Birds, flight of..... 356
 Birds' nests..... 399
 Bismuth, purifying..... 399
 Bituminous macadamized road..... 107
 Blacking, waterproof..... 107
 Bleaching liquor..... 281
 Bleaching wool..... 408
 Blisters, osmose plan for..... 17
 Blood, analysis of..... 307
 Blood, apparatus..... 391
 Blotting, osmose plan for..... 17
 Blowpipe reagents, new class of..... 256
 Blue glass and heat..... 519
 Blue glass and hydrophobia..... 166
 Blue glass blindness..... 384
 Blue glass deception, the, 113, 129, 145
 Blue glass epidemic, the..... 399
 Blue glass in a nutshell..... 184
 Blue glass photography..... 214
 Blue glass science..... 121
 Blue glass skeptics, more..... 150
 Boiler cleaner, new..... 130
 Boiler explosions..... 30, 35, 182, 212
 Boiler, foaming in..... 153
 Boiler scale preventive, a..... 71
 Boiler scale, slippery elm for..... 79
 Boiler tubes, stopping leaks in..... 230
 Boiler, wrought iron safety..... 47
 Boilers and steam pipes, cover-
 ing..... 355
 Boilers, safe working pressure..... 240
 Bolts, dimensions of..... 63
 Bonanza, an Arizona..... 38
 Bones, dissolving with acid..... 166
 Bone meal for grapes..... 321
 Book edges, coloring..... 312
 Books? how do you keep your..... 70
 Boracic acid, test for..... 134
 Borax as an antiseptic..... 244
 Boring, deep, in Switzerland..... 241
 Boring, a \$50,000..... 241
 Bots..... 9
 Braiding thin pieces of brass..... 261
 Braiding tin..... 241
 Bread, flour, etc., adulteration of..... 321
 Brick machine..... 271
 Brickwork, black..... 60
 Bridge, cost of the East river..... 64
 Bridge, the East river..... 143
 Bridge, East river, wire for the..... 127
 Bridge, the New York and Brook-
 lyn..... 225
 Bridge, second, New York and
 Brooklyn..... 49
 Bridge, the Niagara railway..... 297
 Bridge, the Niagara, engineer's
 examination..... 225
 Bridge, the South street, Phila-
 delphia..... 351
 Bridges, dangerous..... 100
 Bridges, railroad..... 68
 Bronze, cleaning..... 133
 Bronzing composition..... 87
 Brushes, varnish, softening..... 47
 Bryant vase, the..... 291
 Buffalo, domesticating the..... 256
 Bull on a track..... 40
 Burner, new Godefroy's..... 339
 Business, man of, etc..... 56
 Business stagnation in Germany..... 257
 Butter, adulteration in..... 249
 Butter and milk..... 391
 Butter, artificial..... 102
 Butter, rejuvenating..... 102
- C**
- Caffeine..... 114
 Calcium salts for wet water..... 273
 Calculating machine..... 294
 Calm muzzie..... 386
 Caliper, a micrometer..... 9
 Camellias, training..... 86
 Canal, cleaning a..... 147
 Capital and labor..... 135
 Car, a new steam..... 347
 Cars, hydraulic propulsion of..... 39
 Cars, street..... 131
 Carriage woodwork, heat and..... 36
 Carriage woodwork, heat and..... 36
 Case-hardening German steel (37) 331
 Cast steel, facing cast iron with..... 29
 Castings, to soften metal..... 214
 Castings, weight of..... 54
 Cat, the..... 295
 Cattle, dairy..... 79
 Cattle food..... 69
 Cavalry equipment..... 43
 Cellular walls, leaky..... 351
 Cement, aquarium..... 214
 Cement, cutter's..... 30
 Cement, fireproof..... 30
 Cement for cracks in cast iron..... 36
 Cement for cracks in horses' feet..... 211
 Cement for fine sand, etc..... 211
 Cement for metal and glass..... 35
 Cement for nitrate of silver baths..... 187
 Cement for paper and iron..... 36
 Cement for rubber and earthen-
 ware..... 19
 Cement for rubber bags..... 19
 Cement for sealing bottles..... 19
 Cement for vases..... 19
 Cement, hard white..... 113
 Cement, London..... 213
 Cement, Portland..... 217
 Cement, waterproof..... 219
 Cementing rubber to steel..... 38
 Centennial awards lawsuit..... 97
 Centennial, a slender result of..... 21
 Centennial lightning rods, the..... 19
 Centennial medals..... 166
 Centennial, minerals at the..... 390
 Centennial surplus, the..... 356
 Chemical magic..... 371
- D**
- Dairy, a gigantic model..... 300
 Dairy interests, the United States..... 199
 Dam, bursting of a reservoir..... 225
 Dams, proof walls..... 199
 Dartmouth College, new president..... 79
 Dates and the date palm..... 111
 Dead, dangers from the..... 255
 Deer horns, cleaning..... 69
 Dentistry, article..... 275
 Diamond, the analysis of the..... 72
 Disinfectant for drains, etc..... 9
 Disinfecting a close room..... 39
 Disinfection and decontamination..... 33
 Distance indicator..... 22
 Dog, the spitz..... 187
 Dog show in New York..... 214
 Door knob screws, holding..... 275
 Drawing scale, new..... 328
 Dredging machine, a new..... 50
 Dredging machine, cheap..... 50
 Drills, sizes of..... 303, 305, 307
 Drug law in New York..... 347
 Dryers or dehydrators..... 384
 Dryers, turpentine, etc..... 380
 Drying house, lumber..... 135
 Dumper, lightning..... 166
 Dyeing, a new..... 166
 Dyeing blue gray on gauze..... 19
 Dyeing cloth black..... 402
 Dyeing cochineal red on flannel..... 9
 Dyeing, cold water..... 123
 Dyeing deep red..... 203
 Dyeing horn and ivory..... 203
 Dyeing light rose..... 5
 Dyeing loose cotton..... 408
 Dyeing, preparing garments for..... 323
 Dyeing ratten..... 371
 Dyeing raw cotton..... 125
 Dyeing straw..... 125
 Dyeing white muslin crimson..... 125
 Dyeing with aloe..... 359
 Dyeing wood blue..... 159
 Dyestuffs, blue, etc..... 103
 Dyspepsia and long life..... 271
- E**
- Eads, Captain, his success..... 138
 Earth's state, late theories on the..... 63
 Earth, the shape of the..... 148, 272
 Editor, wants to be an..... 66
 Education, self..... 289
 Edward, Thomas, naturalist..... 408
 Eggs, decorated..... 275
 Eggs, dried..... 303
 Eggs, shells, to harden..... 321
 Electric bells..... 303
 Electric candle, the..... 339
 Electric fire alarm and bell pull..... 4
 Electric illumination, progress of..... 36
 Electric light, etc..... 36
 Electric phenomena, strange..... 357
 Electrical balance, an..... 196
 Electric condenser..... 347
 Electrical experiment, curious..... 329
 Electrical treatment in wounds..... 374
 Electricity, cutting down trees..... 370
 Electricity, driving horses by..... 291
 Electricity, galvanic and chem..... 391
- F**
- Facts in nature..... 228
 Falence ware..... 103
 Fairhair, statue of Sir W..... 361
 Feathers, renovating..... 29
 Feet, perspiration of the..... 332
 Fermentation in wine, checking..... 10
 Fern, a beautiful..... 329
 Ferric oxide in silicate..... 67
 Fertilization in plants, cross and
 self..... 340
 Fertilization of pear trees, cu-
 rious..... 7
 Files, cracking of..... 63
 Filtration under pressure..... 132
 Fire arms for the Paris..... 162
 Fire at the St. Louis bridge..... 162
 Fire escape, a simple..... 289
 Fire escape, improved..... 294
 Fire escape invention wanted, a..... 356
 Fire extinguisher, new..... 328
 Fire extinguisher, ship's..... 383
 Fire, extinguishing..... 383
 Fire hose and couplings, tests of..... 50
 Fire in ships, detecting and extin-
 guishing..... 89
 Fires, colored..... (16) 171, (18) 267
 Fires, hotel..... 272
 Fireproof construction, a new
 method..... 174
 Fireproof curtain, metallic..... 307
 Fireproof walls..... 307
 Fireproofing hair rope..... 310
 Fireproofing with tungstate of
 soda..... 315
 Fireworks, poisonous..... 197
 Fish, fresh water, and salt water..... 308
 Fish scale, improved..... 308
 Fishing extraordinary..... 313
 Fishlike odor of potable water..... 217
 Five cent pieces, counterfeit..... 137
 Flames, luminous, recent studies
 of..... 9
 Flammé, sensitive..... 331
 Fresh worms..... (48) 139
 Flight, mechanical, experiments
 on..... 179
 Florence, Italy..... 231
 Flour, effect of sunlight on..... 249
 Flour, testing..... 323
 Flower garden, a small..... 229
 Flower, the largest, in the world..... 37
 Flower trade of New York..... 97
 Flowers, artificial, as barometers..... 30
 Fly paper..... 345, (32) 300
 Flying machine, a toy..... 38
 Food steamer, a new..... 80
 Force analyzed..... 80
 Force, centrifugal..... (3) 259
 Forensic..... 358
 Forgers, good..... 228
 Fountain on a spire, a..... 236
 Fountains at Aranjuez..... 343
 Fox, a cunning old..... 7
 Frame clamp..... 147
 France, the Mediterranean coast..... 19
 Franching privilege again, the..... 144
 Friction clutch for shafting..... 177
 Friction of slide valves..... 116, 228, 264, 340
 Frog, a snake-eating..... 34
 Frogs on horses' feet, do not
 pare..... 182
 Frost crystals on windows..... (1) 250
 Frost plant of Russia, the..... 116, 228
 Fruit in Europe, American..... 388
 Fruit trees, French..... 152
 Fruit trees, wash for..... 300
 Fruit trees, winter dressing..... 96
 Fumigator, a new..... 339
 Furnace, a Kouy smelting..... 151

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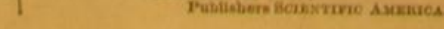
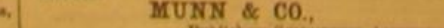
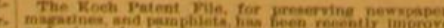
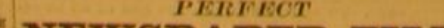
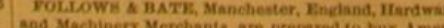
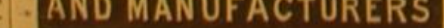
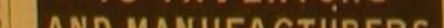
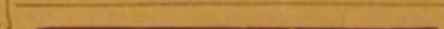
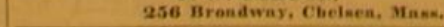
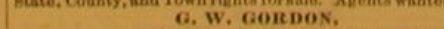
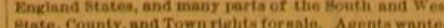
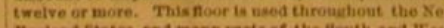
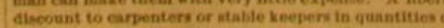
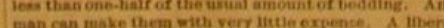
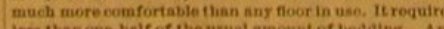
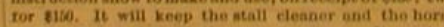
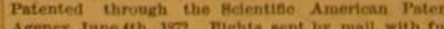
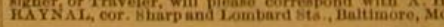
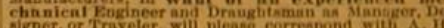
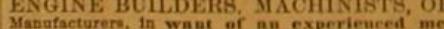
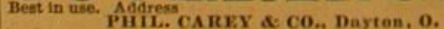
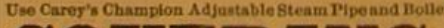
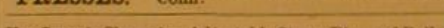
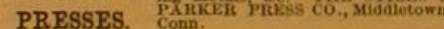
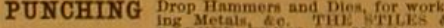
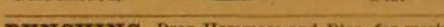
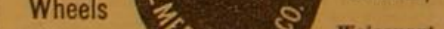
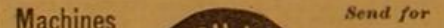
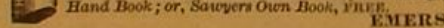
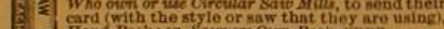
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