SCIENTIFIC AMERICAN

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THE VOLTAIC PENCIL.

There is at the present time scarcely a single branch of industry to which electricity is not lending its aid. Art, however, has thus far received but little benefit from this source, if we except the application of electricity to electro-metallurgy. We are pleased to learn, then, that an important discovery has just been made at Paris by M. Bellet, whose invention consists of a voltaic pencil, by the use of which designers and draughtsmen will be enabled to dispense entirely with the aid of the engraver. The editors of *Electricité* state that they have examined beautiful proofs of lithographs and etchings obtained, without the use of the graver, by the effect of a voltaic arc produced at the point of an ordinary lead pencil. Encouraged by his success the inventor has taken out patents in various countries, and a company has been formed to carry out the process, which will soon be placed before the public. At present there are being prepared models of a series of apparatus which will allow any artist, however ignorant of the mysteries of electricity, to reproduce immediately, and without the aid of any artisan, the most delicate and complicated drawings; and this, too, by a very simple process and at a very moderate price. By a slight modification of the system there may be produced: (1) Stencils analogous to those produced by the Edison pen; (2) lithographs; (3) etchings; (4) stereotypes for typographical work. The initiators of this discovery are confident that an entire revolution will take place in the process of illustrating papers by means of their electrography.

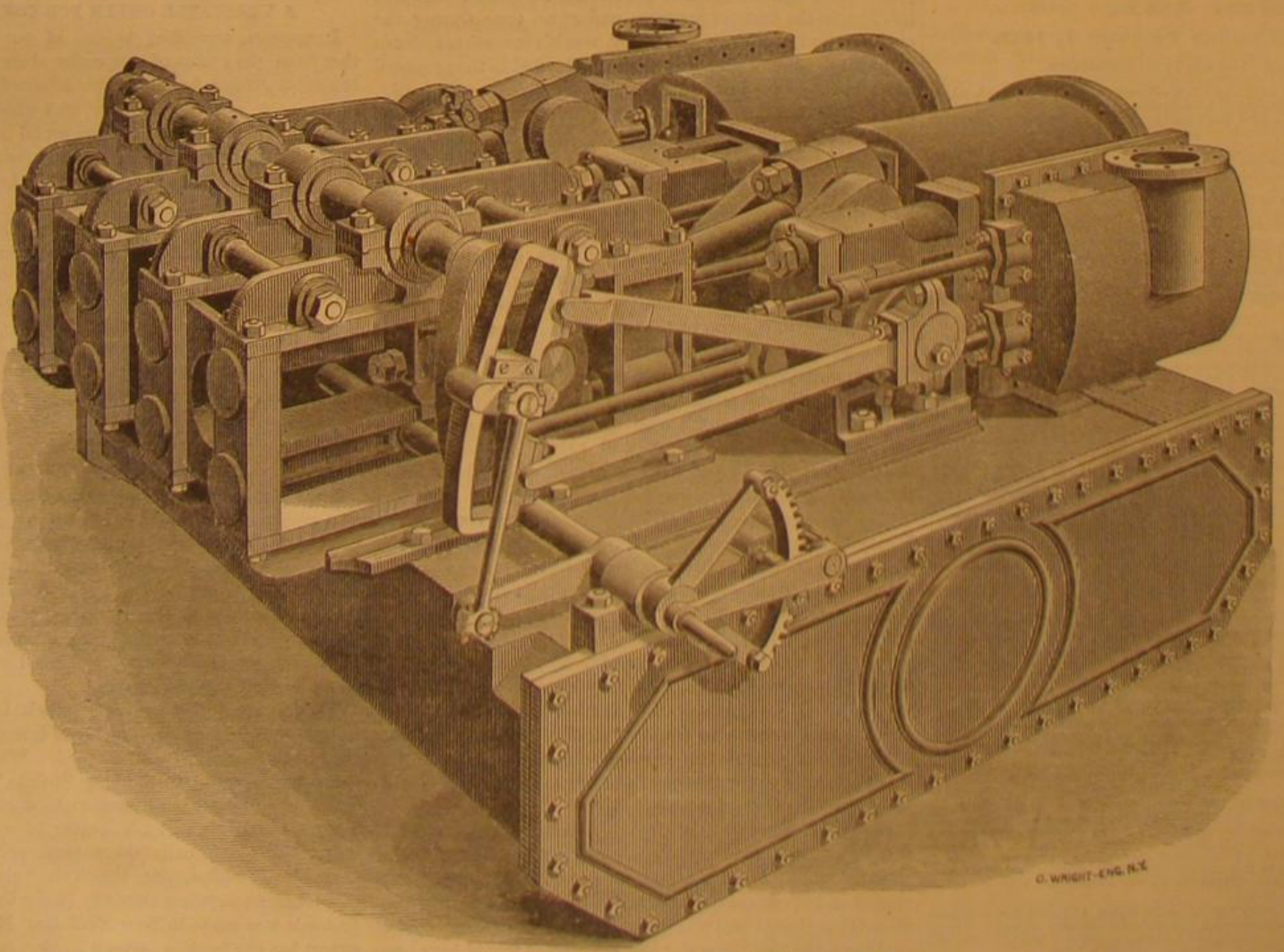
ENGINE OF THE TORPEDO VESSEL DESTROYER.

The engine shown in the accompanying engraving was designed in 1878 by Captain Ericsson for his new torpedo vessel, Destroyer, an engraving of which appears on page 303 in the last volume of this journal. Both engine and vessel were built at the Delamater Iron Works.

The principal features of this engine are, that its base forms a surface condenser, 8 feet square, 24 inches deep, and that the cylinders, which are 24 inches diameter, 22 inches stroke, exhaust directly into the condenser. The cranks are placed at right angles, their journals being supported by pillow blocks bolted directly to the heads of the cylinders. The power of the pistons is conveyed to the connecting rod crosshead by four piston rods, two above and two below, equidistant from the center of the crank shaft.

It will be seen by reference to the engraving that the space between the ends of the valve and the crank shaft is so small that two valve stems become necessary.

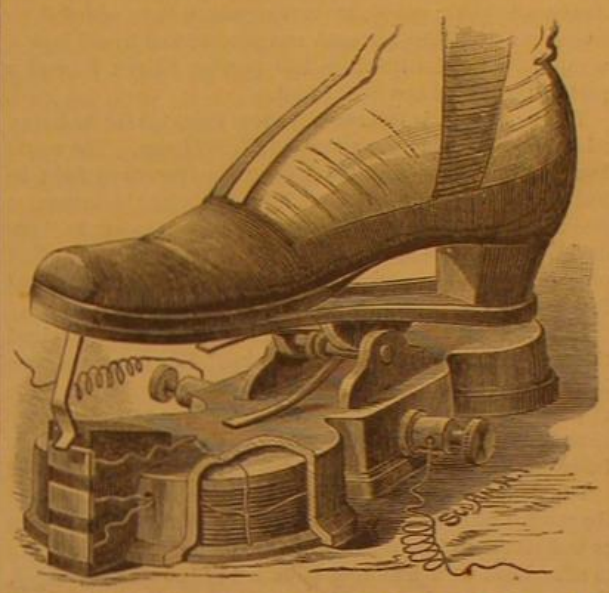
The outer ends of these valve stems are connected by a vertical crosshead, to which the connecting rod of the reversing link is attached. It will be observed that the slide frames are unusually massive, the object being to obtain a firm support for the pillow blocks of two rock shafts provided with vertical vibrating levers, operated by the eccentric rods. The center of the reversing link being sustained by a pin inserted at the middle of the vibrating lever, it will be seen that the motion transmitted to the valve stems is twice that of the throw of the eccentrics. It will be noticed that the eccentrics at the forward end of the crank shaft are very small, an advantage secured by bolting the same to the end of the shaft. The aft eccentrics, of course, are of the usual diameter. It may be mentioned that the steam valves are balanced by accurately fitted saddles of cast iron, under which they slide, effectually relieved from the heavy steam pressure (120 lbs. to the square inch) employed in these engines.



ENGINE OF CAPTAIN ERICSSON'S TORPEDO BOAT, "DESTROYER."

A NEW SWITCH PEDAL.

This novel device, which is the invention of Mr. C. A. Hussey, of 163 East 33d street, New York city, is designed



HUSSEY'S SWITCH PEDAL FOR CONTROLLING ELECTRIC MOTORS.

for controlling the electrical current employed in propelling small motors for driving sewing machines and other light machinery. A pedal is pivoted to the hollow base, and carries a spring that bears upon the block of insulating material at the toe of the base piece. This block is grooved transversely, and in the grooves are fitted three bars of metal, either of which may be touched by the contact spring as the pedal is pressed downward. The hollow base contains two resistance coils and the wires which connect them with the binding posts seen on opposite sides of the base. This apparatus being connected with the electrical conducting wires of an electric motor, to start the motor, it is only necessary to depress the pedal so that the contact spring touches the first metal bar; the current then passes through both resistance coils and is thereby weakened. Should the power prove insufficient the pedal is further depressed so as to bring the spring into contact with the middle bar; this cuts out one of the coils and diminishes the resistance. By pressing down the pedal so that the spring touches the lower bar, the current passes directly, and its full power is realized; as the pedal is released the reverse of what has just been described occurs.

A Chance for Inventors.

There is a demand for a hand loom for amateurs' use. A correspondent writes: "We can get lathes and fret saws and printing presses and other machinery for the use of amateurs in abundance. But a compact, portable hand loom would be a novelty, of which it might with some truth be said that no house would be complete without it."

The number of people seeking industrial recreation is very large, and out of these a profitable clientage can be secured, no doubt, by whoever will offer them the novelty called for. It may pay some of our inventive readers to give the matter a little practical consideration.

New Mechanical Inventions.

Mr. John T. O'Harra, of Dodge City, Kansas, has patented an improved Car Coupling, which is so constructed that the cars will couple themselves when run together, and they may be uncoupled when standing still. The coupling may be operated from the top and sides or from the platform of a car.

An improved Hydraulic and Wire Rope Pumping System has been patented by Mr. William P. Barclay, of Virginia City, Nevada. The object of this invention is to provide apparatus for economically raising water from mines and deep shafts, and it consists in the arrangement of a hydraulic engine, with a series of plunger and other pumps, and a system of wire ropes and connections.

An improvement in Railway Cars has been patented by Mr. Louis Prince, of Nashville, Ohio. It consists in constructing the sides or panels of the car in sections so as to fold together, and in a window casing carrying a sliding sash adapted to swing inward.

Mr. Arthur C. Gould, of Boston, Mass., has devised an improved Street Sweeper, having an endless belt of brushes, operated by gearing from the axle of the machine, which belt sweeps the dirt upon an apron and carries it to a receptacle. The belt can be raised and sustained out of operation when that is desirable, and in use it adapts itself to the surface of the street.

Mr. William Loudon, of Superior, Neb., has devised an improved Double Acting Lift and Force Pump, which is so constructed as to throw a continuous stream of water by means of a peculiar arrangement of piston and valves.

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The Carpet Beetle and other Domestic Pests. By DR. H. A. HAGEN. History of the insect. Helps to prevention. Fleas and their prevention. Other insects. Polish flea traps. How animals and plants emigrate. European insects that enter this country.

SOME PATENTS THAT SECTION 11 WOULD HAVE KILLED.

The object of Section Eleven is to make void certain patents described as undeveloped and useless, yet involving principles or devices which subsequent experimenters may want to use. To accomplish this end a special tax is laid upon all patents, in a fee of $50 at the end of four years and another fee of $100 at the end of nine years; non-payment of either killing the patent.

It is argued that if an invention has any real merit its profitable development will speedily follow, as a matter of course; in which case the additional fees will be no serious burden. If, however, the invention is not at once profitable, or if the inventor does not believe in it sufficiently to be willing to pay $150 for the confirmation of his right, it may be fairly presumed that the invention does not constitute a progress in the arts, and accordingly does not deserve the protection of the law. All such undeveloped inventions, it is claimed, are virtually abandoned by their owners; and, although the patentee has done nothing contrary to his agreement with the nation, nothing to warrant the forfeiture of his right, the nation may justifiably break its part of the contract and allow the inventor's right ("exclusive right," in the terms of the Constitution) to be freely invaded.

The fallacies which underlie this specious argument have been repeatedly exposed in these columns and elsewhere. We do not propose to discuss them here. Our purpose is rather to note briefly some of the inventions for which America is justly proud, inventions which have added enormously to the nation's wealth and power; and to ask how it would have fared with them had Section Eleven formed a part of the patent law of the past.

To no one man is this country more indebted for its industrial and commercial rank than to Eli Whitney. The world knows what a long and, for many years, profitless fight he had to wage with prejudice and injustice before his invention was so far established as to be beyond condemnation as "undeveloped and useless." What would have been the effect of adding to his already overwhelming burdens the additional fees prescribed by Section Eleven?

In 1833 Obed Hussey patented an invention which solved the problem of the harvesting machine. For many years he labored almost in vain to advance his invention to the stage of practical and profitable usefulness. Would the country have been equally benefited had his right and his efforts fallen under the encouraging (!) influence of Section Eleven?

The early struggles of Elias Howe, Jr., the inventor of the sewing machine—struggles against poverty and injustice as well as the stolid prejudice of the community—are known to all. His first machine was finished in the spring of 1845. Four years after he was alone and poor in a foreign land. He was indebted to the kindness of a Scotch mechanic for a steerage passage home. He found his wife and children destitute, all their personal effects being still detained to secure the payment of their passage home. His wife was sick; ten days after his arrival she died. He was penniless; and just at that moment, had Section Eleven been in force, he would have had to pay $50 or forfeit his right to his invention.

The real value of the Goodyear rubber patent will not be questioned at this late day. Taking up the struggle under which Heywood had succumbed, Goodyear toiled through years of terrible privation to perfect his invention. Success left him in the deepest poverty; and at no time during the entire period of the original patent was his invention a source of profit to him. Under provisions embodied in the proposed amendment to the law the spoilers of Goodyear could easily, and at any time, have dispossessed him of the last remnant of right.

The Sarven carriage wheel is known the world over. Section Eleven would have killed the patent on it most certainly and effectively. During the first eight or ten years of the life of the patent the inventor's efforts to induce carriage makers to adopt his improvement were almost fruitless. His efforts were persistent, his diligence remarkable; yet his invention was commercially "undeveloped and profitless," almost to the end of the term of the patent.

The struggles of Woodworth alone, and afterward with his partner Strong, to persuade men to adopt his method of finishing boards by machinery, up to the time of his death in poverty in the eleventh year of his patent, would make a volume. His invention was radical, valuable, era making in the art of carpentry; yet Section Eleven would have killed his patent without compunction.

Another radical and immensely valuable invention was Henry Voelter's process of making paper-pulp from wood. The best years of the inventor's life were given to the development and introduction of the improvement, and in combating the prejudice of the trade to the use of wood pulp in paper. He was able and willing to spend the greater part of the life of his patent, and $70,000, in demonstrating the usefulness of his idea. He may have been able to pay the additional fees prescribed in Section Eleven; another inventor of the same or an equally valuable process might not. In either case would the payment or non-payment of the fees have been any evidence of the intrinsic worth or worthlessness of the invention?

Daniel Lamson invented a machine for notching hoops. It was not a great invention, yet it was novel and unquestionably valuable. He was a poor man; and before he had succeeded in introducing his invention he enlisted in a Massachusetts regiment and was killed at Fredericksburg. Just at that time, the first fee under Section Eleven would have been demanded of his widow by the Patent Office—a penalty for invention!

It is needless to multiply cases. From the history of inventors and inventions in this country hundreds of similar instances might be drawn. In a very able paper lately read before the Cincinnati Board of Trade, Mr. George H. Knight has furnished a long list of them—instances of patient, persistent, and long protracted struggles against poverty and class prejudice, to bring valuable inventions up to the point of profitable and established usefulness; instances of inventors now ranked among the world's best benefactors, who would have been cheated of their rights, and the progress of the useful arts thereby delayed indefinitely, had there been any Section Eleven to thwart their efforts. From the very nature of things the most pregnant and novel inventions are the hardest to make commercially successful; and it is these rather than the trivial catchpenny inventions or the inherently worthless inventions, that would suffer most from the killing influence of the proposed amendment; and it is these that the country can least afford to discourage or to destroy.

GLUCOSE HONEY.

For a long time strained honey has been so largely adulterated with glucose, that intelligent buyers are very shy of honey in that state. Honey in the comb, however, especially if the comb is clean and white, disarms suspicion, though it is well known that respectable grocers are accustomed to surround comb honey in jars with clear honey mixed with a small percentage of glucose, to prevent the granulation which occurs in pure honey exposed to the light. One does not object to the use of a little glucose for such a purpose, though the preserving sweet is worth in market only one tenth as much as the sweets preserved. It is a very different matter, however, when the comb itself is filled with glucose, and the fraudulent substance is sold as genuine honey.

Mr. J. Hasbrouck writes to the *Bee Keeper's Magazine* that his attention was lately called to some fine looking comb honey sold by a grocer in Williamsburg. He bought some of it at twenty-five cents a pound. It was very white, put up in the neatest possible box, and was altogether the finest looking honey he had seen this season. It had a nice flavor of pennyroyal, and was so unlike glucose that he decided, without testing, that his friend's suspicions were wrong, and that it really was honey. It was placed on the tea table with some clover honey, and although the family all preferred the suspected comb on account of its fine appearance, the unanimous decision after eating was that the honey was not good. It was then thoroughly analyzed, and found to be "simply glucose diluted with water and flavored." Mr. Hasbrouck carried a sample to New York, and veterans in the honey trade almost invariably pronounced it splendid honey until they saw it tested.

This is carrying the matter altogether too far. It is well enough to manufacture honey comb for saving the labor of bees, so long as the bees are allowed to furnish the filling; and there may be no vital objection even to the selling of paraffin cells filled with glucose as a cheap substitute for the industrial product of bees, if any one wishes to eat it. But to sell such compounds for honey, at the price of honey, is the refinement of swindling, and ought to be punished as such.

A VEGETABLE GREEN FOR CONFECTIONERS.

It appears, according to one of our French exchanges, that from the grains of raw coffee there may be extracted a beautiful green coloring matter adapted to all the purposes of the cook and confectioner, and which will undoubtedly prove of great value as a commercial product, inasmuch as the number of green colors suitable for such uses, and which are not poisonous, is very limited. According to M. Zech, who describes the process of extraction, the coloring matter is obtained in the following way: The coffee grains are crushed and the oil is extracted by means of ether; they are then dried and agitated with the white of eggs, so as to form a sort of paste, and the latter is exposed for several days to the air. The presence of the white of eggs then determines the appearance of an emerald green. A simpler process is to merely moisten the crushed and desiccated coffee berries with water, expose them three or four days to the air, and extract the coloring matter by means of alcohol.

A NEW INDUSTRY.

For a number of years a Boston firm, emulous of the success which has attended the canning of baked beans, has been trying to discover a method for preserving the freshness and flavor of that other essentially Boston product, the codfish ball. They have at last succeeded, the Boston *Advertiser* reports, and the rapid demand for the article the world over seems to prove either a wide dispersion of New Englanders or else a widespread need of such an addition to the world's kitchen supplies.

The fish are killed by being stuck in the neck, and are hung up until every drop of blood is removed, and the napes are carefully scraped and cleaned. When salted and dried the fish are equal to the best Phillips' Beach fish. Nova Scotia potatoes are used, and instead of pork fat, the best Vermont and New York butter is contracted for at the dairy. The fish balls are packed solid in tin cans and hermetically sealed, after which they are put up in cases of ten dozen each, when they are ready for the market. The first sale was made in New York last May, and to such an extent has the business grown in nine months that the firm employ a force of 250 men and women in preparing and packing the fish balls, and 60 tinners in making the cans.

Since the 1st of September 20,000 bushels of potatoes have been used, and the codfish comprises several hundred quintals. The goods are shipped by the carload to Chicago St. Louis, San Francisco, Pittsburg, and other Western points. A case of the goods was on exhibition at the Paris Exhibition, for which a medal was awarded, and orders have been filled for France, England, Scotland, South America, Turkey, and China.

THE LAUNDRIES OF NEW YORK.

The manager of one of the larger laundries of New York lately said that there were between five and six hundred important laundries in the city, counting steam laundries that do the work of large manufacturers of white goods and of hotels and restaurants, and the hand laundries doing household work. The first steam laundry was started in Boston, in 1853. Several steam laundries in New York employ from 100 to 150 hands. The Empire Laundry, doing the work of fifteen hotels and restaurants, turns out 40,000 pieces a day, or more than 1,000,000 a month, washed, dried and finished. These pieces include sheets, pillow cases, white towels, silver towels, brown towels, brown table cloths, white table cloths, napkins, curtains, jackets, aprons, counterpanes, blankets, bed covers, pillow covers, chair covers, table covers, crumb cloths, and doilies. In the performance of this work there are used $4,000 worth of soap, $1,000 worth of starch, $250 worth of bluing a year, and the pay roll amounts to $25,000 yearly.

Another laundry manager said that the amount of private washing done in the public laundries has increased immensely since the establishment of the first large public laundry, the New York, at Bergen, N. J., in 1866. The largest are the St Denis, California, Home, Stuyvesant, and New York. The work they do is mainly for persons living in flats, boarders, bachelors, and transient hotel guests. Notwithstanding the great facilities offered by the public laundries, most housekeepers prefer to have their washing done at home. The public laundries that do private washing do not use steam or any machinery except the simple "patent wringer" and "housewife's washboard," because no machinery ever invented could do the necessary fluting, puffing, scalloping, and doing up. The charges range from 75 cents to $9 a dozen.

The laundry business requires very little capital; the work is simple and the terms are invariably cash. No class of business men lose so little money from bad debts as the laundry men, and the reason is plain; they always have ample security for their bills in the clothing that they wash, and clothing is never returned until the bill is paid.

It is estimated that from one and a half to five million dollars are invested in laundries in New York, giving employment to from ten to twenty thousand persons.

HAECKEL ON EVOLUTION.

In his reply to Professor Virchow's charge that the evolution theory is as yet a matter of opinion, not a demonstrated position in science, Professor Haeckel takes occasion to state very forcibly the nature and scope of the theory of descent and the broad ground of fact on which it rests.

However complex in its details, the great problem of organic derivation is essentially simple. Species must have come into existence in one of two ways—by natural development or by supernatural creation. There is no third way. On the one side is the old theory that organisms were created specifically distinct, as they are, as they were, as they ever must be, independent in origin and permanent in form and character. On the other hand stands the theory that the different species of organisms are intimately related, have developed naturally from earlier forms, have descended from common ancestral types. On which side lies the weight of evidence? At starting, Professor Haeckel concisely defines the relation of the three great theories of modern biology: 1. Monism, the universal theory of evolution, or the monistic progenesis theory, is the only scientific theory, which rationally explains the universe and satisfies the desire for causality in the human mind, since it brings all natural phenomena into a mechanical causal connection as parts of a great and uniform (*einheitlich*) process of development; 2. Transformism, or the theory of descent, is an essential and indispensable part of the monistic evolution theory, because it is the only scientific theory which explains the origin of organic species in a rational manner, namely, by transformation, and reduces this transformation to mechanical causes; 3. The theory of selection, or Darwinism, is up to the present the most important one among the different theories, which try to explain the transformation of species by mechanical causes; but it is by no means the only one. Even if we suppose that most species have originated through natural selection, yet we know, on the other hand, that many forms called species are merely hybrids from two different species and are propagated as such; at the same time we can easily conceive that other causes may be acting in the formation of species, causes of which we have no idea at present. To decide what importance natural selection has in the origin of species is left to the judgment of the various naturalists, and in this question the authorities differ materially even to-day. Some ascribe a greater, others a smaller importance to it. But the different estimation of the value of Darwinism is quite independent of the absolute validity of the theory of descent, because the latter is up to the present the only theory which explains, in a rational way, the origin of species.

The theory of creation explains nothing, and is inconsistent with a vast multitude of demonstrated facts and laws. The scientific certainty of the theory of descent, on the contrary is based upon the totality of biological phenomena. Professor Haeckel shows that all phenomena of morphology and physiology, of chorology and œcology, of ontogeny and palæontology, can only be explained by the theory of descent, and reduced to mechanical causes. The guarantee of the truth of the theory lies particularly in the fact that the last simple causes are the same for all these complicated phenomena, and that other mechanical causes cannot be imagined. If further proofs are demanded, where are they to be looked for? In Professor Haeckel's words, "where in the world are we to find 'facts' which speak louder than the facts of comparative morphology and physiology, the facts of rudimentary organs and of embryonal development, than the facts of palæontology and of the geographical distribution of organisms—in short, than all the known facts from the most various biological domains?"

If the theory of evolution is not amply proved by the facts already in possession, then, Professor Haeckel asserts, the theory never will be proved.

A GREAT MARKET FOR OUR CATTLE AND OTHER PRODUCE.

Under rules lately adopted by the British Government, which went into effect on New Year's Day, the United States will have the advantage over many other countries in landing cattle in the United Kingdom, as from Russia, Austro-Hungary, Turkey, Greece, Italy, and Roumania live cattle cannot be landed, and from Germany, Holland, Belgium, and France cattle can only be landed at six ports, under strict inspection, to be slaughtered within ten days of their arrival; but cattle from Denmark, Sweden, Norway, Spain, Portugal, and the United States are exempt from compulsory slaughter or quarantine.

The immediate effect of these rules will be to confine the large supply of cattle required by England to a few purveyors, among which the United States is much the largest producer, as the severity of the regulations will practically prevent the nations in the second list from engaging actively in the live cattle trade, and those in the last list, with the exception of Canada, have comparatively few cattle to export.

More than 60 per cent of the people of Great Britain are dependent on foreign food supplies, while her steadily growing population is increasing this dependence every year.

The numbers of live animals imported into the United Kingdom during the year 1877 were about 300,000 cattle, 1,000,000 sheep, from 40,000 to 50,000 swine, 30,524 horses, and the imports of last year are believed to largely exceed those numbers. Since the 1st of last May and up to the 1st of September there have been an average of 3,000 cattle a week shipped to Great Britain from Montreal, Boston, New York, Philadelphia, and Baltimore. This trade, however, is in its infancy as yet, and will, without doubt, grow immensely before long, when the best methods of shipping have been devised and the prejudices against American meat been overcome. With the immense quantity of cheap grazing lands we have we can defy competition to other countries in raising cattle.

Returns of British grain imports from the various countries for a period of nine months ending October 31, 1878, show:

From.	Cwts.
Russia	7,432,443
Germany	4,112,184
France	11,061
Turkey, Wallachia, and Moldavia	200,857
Egypt	193,194
United States (on Atlantic)	20,903,997
" " (on Pacific)	4,208,942
Chili	49,994
British India	1,577,342
Australia	1,309,559
British North America	1,968,244
Other countries	214,285
Total	42,182,103

From this it will be seen that the total quantity received from the United States was 25,112,939 cwts., or 59½ per cent of the total importations.

The annual importation of food into Great Britain is about $800,000,000 worth, of which a large proportion will be drawn from this country if we pay proper attention to the business. To make the most of this grand market every facility should be given to shippers by cheapening freights, lessening the amount of handling or transferring from cars to vessels, or *vice versa*, and increasing our inland water transportation facilities, as the difference of a cent or two per bushel in the cost of freighting or handling grain may largely influence the trade in that article and make all the difference between a very profitable business and a losing one.

A HINT FOR AN INVENTION.

We call the attention of inventive and practical men to the defects of locomotive boilers, and the advantages which would result from their improvement.

A locomotive boiler has three principal parts, all imperfect in greater or less degree. These are the fire box, the tubes, and the smoke box. The fire box has rectangular walls, surrounded by water, except under the grate, and where the fire door is placed. This is an arrangement necessitated by the requirements of science and not indicated by rules of utility or good construction. The flat form of the fire box walls and of that part of the boiler which covers it, takes away from them strength of resistance, save what is given to each by the other by stays in immense number. These must resist an enormous pressure, especially the roof of the fire box, where it is not counteracted by any opposite pressure, and sometimes may amount to 200 tons.

This arrangement prevents proper cleaning of the outer walls of the fire box and the inner walls of the boiler plates opposite. It is about the same thing where the tubes are; and these, rarely over 2½ inches in diameter, are so numerous that it as difficult to clean them exteriorly as it is to clean that portion of the boiler surrounding them.

The draught, urged by the jets of exhaust steam in the stack, is so strong that the air and gases in passing through the tubes at a high rate of speed drive with it a considerable quantity of fine dust, the residue of combustion of coke or other fuel; this dust scratches and cuts the tubes so as to necessitate their renewal. The dilatation and contraction of these tubes also cause leaks and repairs. The forced draught also costs dear in another way; because this steam jet creates a back pressure in the cylinders, frequently amounting to one third the effective pressure. Further, the space left above the tubes and the smoke box is so small as to reduce too much the proportion between the steam volume and the heating surface. It is also not unfrequent that the steam carries with it half its weight of water.

Ancient Letters in Modern Tattooing.

At a recent meeting of the British Anthropological Institute Mr. Park Harrison read a paper on some characters which are still in use as tattoo marks by the Motu, a people located in the southeastern peninsula of New Guinea, and described by the Rev. Dr. Turner as a race superior to the Papuans, from whom they differ both in color and customs. About half of the more distinctive forms tattooed on a Motu girl, carefully copied by Dr. Turner, correspond with letters in the Asoka inscriptions in India, which are believed to be allied to Phœnician, while several others resemble letters admittedly derived from the same stock, but independently acquired. The marks are mostly arranged in groups of three; on the right arm, however, nine or ten are apparently connected by a line running above them all. The characters are twenty-three in number, and are formed of straight lines in the following combinations, viz.: five of 2 lines, nine of 3 lines, five of 4 lines, and three of 5 lines, much in the same proportion as in the Rejang and Lampong alphabets of Sumatra, the letters of the former of which have been shown to be identical with Phœnician characters reversed. Archaic forms of letters have also been met with in several islands of the Indian Archipelago and Melanesia, but are now without meaning. The Motu characters are used simply for ornament or as charms. As an example of the use of letters for tattoo marks, the case of the Austrian subject was cited, who, having been taken prisoner in Burmah, a few years ago, was there tattooed with letters and other patterns. Besides the characters on the Motu girl, there were various pictures, or hieroglyphics, consisting of eyes and eyebrows, a lunar crescent, and other forms.

How Diphtheria was Spread.

A few weeks ago a little girl in St. Albans, who had just recovered from diphtheria, was taken by her parents to visit a family in a neighboring town. She slept with the children in that family, and shortly afterward three or four of them were taken with the malady, and some have since died. The family permitted relatives and neighbors to visit them, and the result is several cases in the neighborhood. They had public funerals, even keeping the remains of one child an unusual time, waiting for another to die, so as to bury them together; and this also spread the contagion. The physician was not powerfully impressed—as some physicians are not—with the contagious character of the disease; therefore, he did not take the necessary precautions for the protection of the neighborhood or of his own family, and the result is that one of his own children has died and another is dangerously ill. A lady who went to one of these houses to robe the victims for the grave has called at houses in the vicinity where there are children, without any change of her garments or any attempt at disinfection, and has fondled the children in those families, apparently in utter ignorance of the danger to which she was exposing them.—*St. Albans (Vt.) Messenger.*

Women Inventors.

The question is often asked us: Do the inventions of women ever amount to anything? From our long experience with inventors of both sexes, we conclude that a larger proportion of inventions patented by women prove useful and profitable than those of the sterner sex. We see by the New York *Sun* that the Metropolitan Elevated Railway Company has selected a device, from the many that have been under consideration, for lessening the noise of the trains, and that it is the invention of a Mrs. Walton, of this city. The plan consists of boxing the rails in a mixture of sand, tar, and cotton, and has been under test for two months on several blocks of the road in Sixth avenue. The ringing of the wheels on the rails, which makes a large part of the objectionable sound, is considerably deadened. She gets, according to the *Sun*, $10,000 for the use of the invention on the Metropolitan line, and the company is to control its adoption on other roads, paying her a royalty.

THE DEMENGE ENGINE AND BOILER.

Our illustrations, which we take from *Revue Industrielle*, represent a compound steam engine and boiler, constructed by Mr. Demenge, and received with much favor in France. Fig. 1 shows a stationary engine. The steam enters the smaller high pressure cylinder first, expands partially and then passes into the larger cylinder, where the expansion is completed. Pressure is exerted only between the exterior head of the cylinder and the pistons, and not on the inner surfaces of the latter. The cylinder heads and the pistons are partially covered with lead, which, being a poor conductor of heat, diminishes condensation.

The connecting rods being subject to compression only, and acting in opposite directions on the shaft, may be made of cast iron, and the cranks may be smaller than in ordinary engines.

The velocity of this engine may be greater, and consequently a larger amount of work may be accomplished than by other engines of similar dimensions. The condenser pump has no exhaust valve, but its piston is connected with that of the low pressure cylinder in such a manner that it acts only during one quarter of the revolution, commencing just when the action of the piston of the large cylinder on the crank and shaft ceases. The cylinders and valves are so proportioned that the pressure on the pistons remains the same throughout the stroke, no matter what may be the degree of initial pressure and expansion in the high pressure cylinder. Tight joints placed at each side of the shaft prevent the air from entering the large cylinder.

The shaft is made of steel; the surface subject to friction is rather large, and is automatically lubricated.

The regulator does not act on the distributing mechanism directly, but operates on a separate valve. Fig. 2 shows the engine combined with a portable boiler, for agricultural purposes. Although rather clumsy and more complicated than desirable in agricultural machines, it is yet said to recommend itself by its economy in regard to fuel.

The boiler, of which Fig. 3 shows sectional views, is of the Thomas-Laurens type, and is placed in oblique position; this is done to prevent any water from being carried along with the steam and to facilitate the attachment of the tongue. Fig. 3 illustrates the position of the tubes, which are partly surrounded by water, partly by steam.

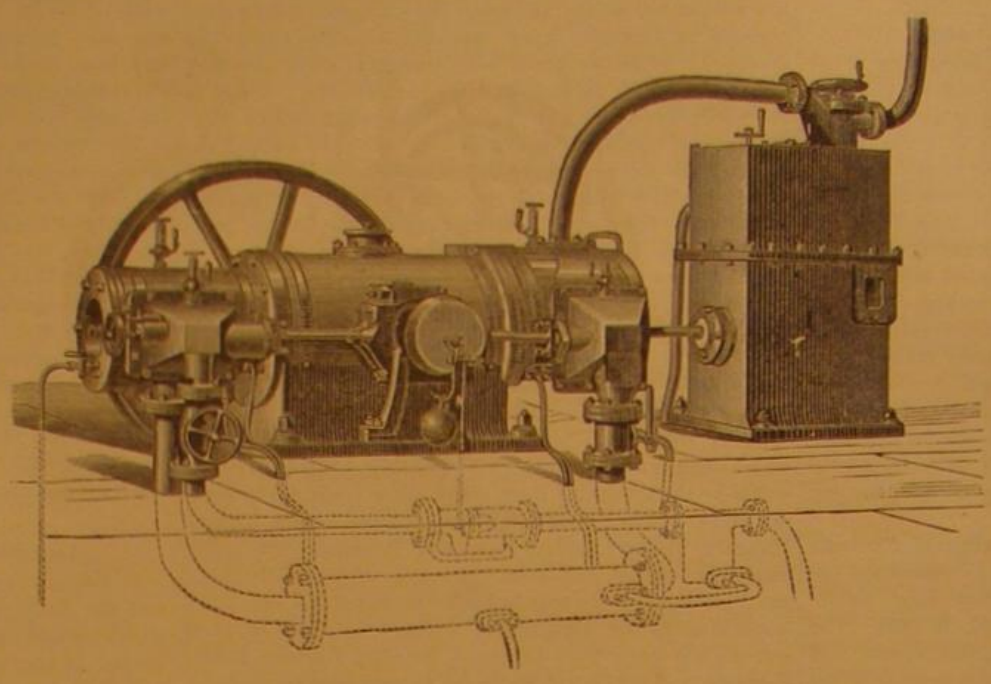


Fig. 1.—STATIONARY DEMENGE ENGINE.

Chinese Dentistry.

It is well known that the Chinese attribute toothache to the gnawing of worms, and that their dentists profess to take these worms from decayed teeth. But how they performed this trick, and so artfully concealed it in the hurry of daily business, was a secret only recently solved by a European inquirer. After some difficulty and delicate negotiation, an intelligent looking native practitioner was induced to hand over the implements of his trade, together with a number of the worms, and to give instructions in the method of procedure. When a patient with toothache applies for relief, if the tooth is solidly fixed in the socket, the gum is separated from it with sharp instruments and made to bleed. During this operation the cheek is held on one side by a bamboo spatula, both ends of which are alike, and on the end held in the hand some minute worms are concealed under thin paper pasted to the spatula. When all is ready, this is adroitly turned and inserted in the mouth, and the paper becoming moistened is very easily torn with the sharp instrument used for cutting the gums; the worms mix with the saliva, and the dentist, of course, picks them out with a pair of forceps. The patient having ocular demonstration that the cause of the disease has been removed, has good reason to expect relief, which in many cases would naturally follow the bleeding of the gum. When the pain returns, the same operation is performed over again, and a fresh supply of worms fully accounts for the recurring trouble. These worms are manufactured in quantities to suit the trade, and they are very cleverly done; still, to carry out the delusion fully, the dentists are obliged to keep on hand a few live worms to show their patients, explaining that most of those taken from the tooth are killed either by a powder which is often applied, or by the process of removing them with the forceps. This is resorted to when the tooth is firmly set.—*Chambers' Journal.*

Telegraph Messages through Metallic Tubes.

When the plan of delivering messages through tubes from the main telegraph building in this city to the most important business marts was first adopted a description of the tubes and operation of the pneumatic arrangement was described in the SCIENTIFIC AMERICAN. More recently an account of the success of the enterprise has been published in the Philadelphia *Press*, from which we copy:

Great are the economies of machinery, commences the writer. Two years ago the Western Union Telegraph Company came to the conclusion that the business of getting

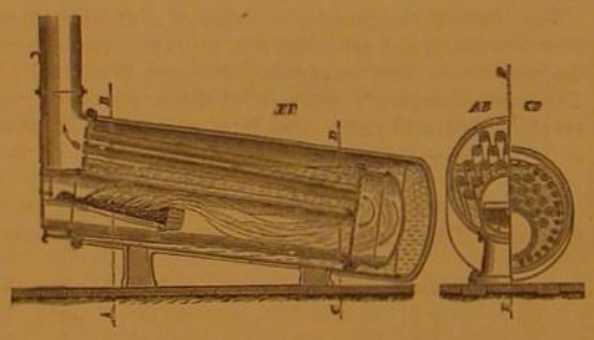


Fig. 3.—THOMAS-LAURENS BOILER.

messages from the main office on Broadway to Wall street and back was costing the company and the public more than necessary. In order to cheapen the expense of the large volume of business emanating in that part of the town, the company laid brass pipes, properly protected from the moisture, down Broadway and Wall and Broad streets to the Stock Exchange and the branch telegraph office there, and other pipes down to the Cotton Exchange and to the branch office near by there. These were pneumatic tubes, 2¼ inches in diameter. They were four in number—two of them "up" tubes, as they are called, worked by exhausting the air and making a vacuum, and two of them "down" tubes, worked by pressure. The messages were rolled up thereafter and placed in little leather boxes, open at one end, and about 6 inches long, and shot back and forth between the main and branch offices, instead of being sent by messenger boys or telegraphed over the wires. The company is now exchanging from 3,000 to 4,000 and more messages a day, through their pneumatic tubes, between the main office on Broadway and the branch offices at and near the Stock and Cotton Exchanges. It saves thereby the labor of at least 25 telegraph operators, and the public is saved much expense.

The tubes are, two of them, 2,100 feet long (the Wall street tubes), and two are respectively 3,000 and 3,500 feet long. They are worked by a steam engine, which has a capacity of 75 horse power, but which is never called upon for half its resources. An engineer and four boys at the tubes are all the employes needed in place of the 25 skilled operators.

This system has worked so well in the business emanating in the commercial and financial quarters of the city, that it is to be extended to Printing House Square, connecting with the offices of the principal daily newspapers.

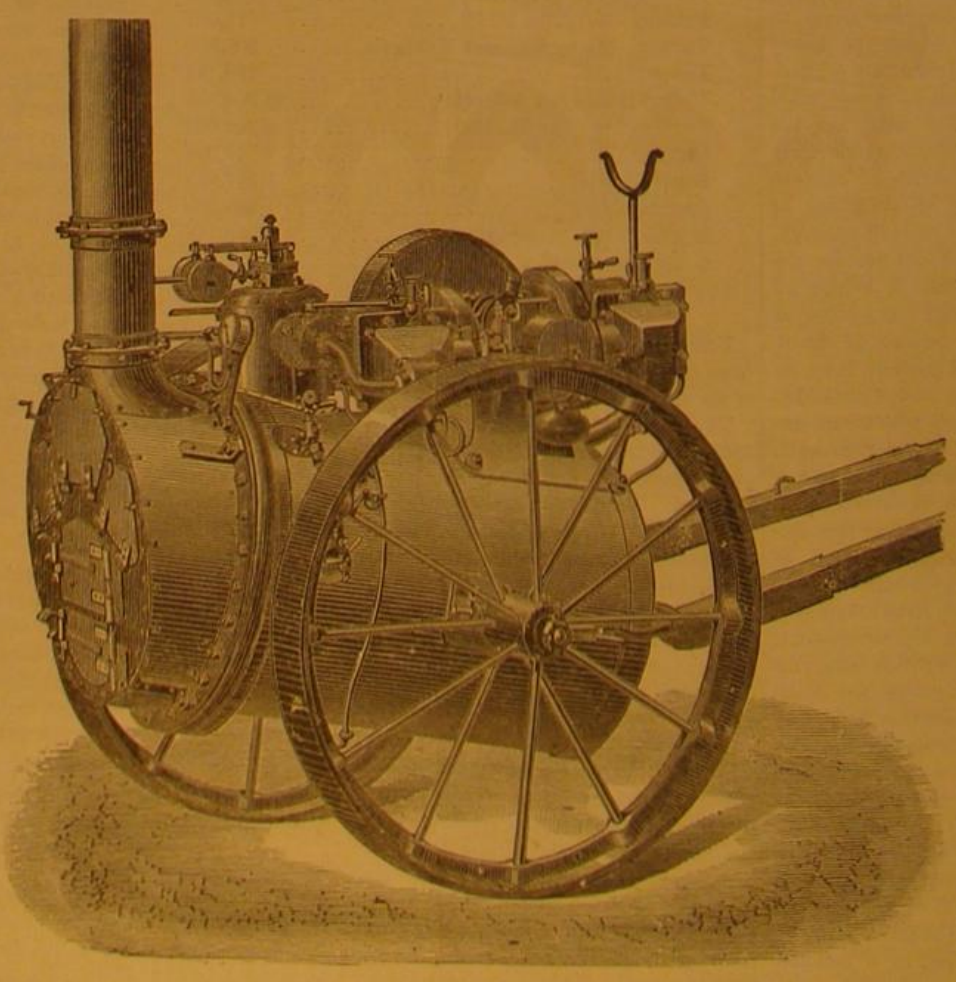


Fig. 2.—PORTABLE DEMENGE ENGINE.

New Inventions.

An improved apparatus for use in photographic galleries as an accessory in forming backgrounds for pictures has been patented by Mr. William F. Ashe, of New York city. It is so constructed that it may be arranged as a staircase, a balustrade, or a pedestal, as may be required.

Mr. John A. Caldwell, of Brownsville, Tenn., has patented an improved Compound Beveling Instrument for the use of stair builders, carpenters, millwrights, and others, by which complicated cuts, such as the pitches of handrails and bevels of jack rafters, are easily obtained.

An improved Attachment to Stemwinder Watch Cases has been patented by Mr. Joseph Fortenbach, of Carlstadt, N. J. The invention consists in a perforated metallic plate fitted upon the winding stem and interposed between the lock spring and the center ring of the watch case, to operate the spring at one side of and out of contact with the stem.

Mr. Gilbert W. Bradley, of Sunderland, Vt., has patented an improved Wooden Box. The process consists in bending wooden veneers into tubular shape under successively decreasing arcs and increasing pressures, and sewing together the lapped edges.

Messrs. Hiram D. Jewett and Israel D. Jewett, of St. Omer, Ind., have patented an improved Mechanical Telephone, which is so constructed as to receive the full volume and force of the voice and other sounds, magnify them, and transmit them to the instrument at the other end of the line with distinctness, so that they can be clearly heard at considerable distance from the instrument.

Mr. Lawrence Klemm, of Terre Haute, Ind., has patented an improved Apparatus for Cleaning Middlings by means of a force and suction draught.

The device is of simple construction, and requires less power than the complicated machinery at present employed for separating the middlings from the lighter particles.

Mr. Marshall R. Dowlin, of North Adams, Mass., has patented an improved Attachment for Flexible Leather Covered Horse Collars of double harness, for the purpose of protecting the throat of or lower end of the collars from wear, and from being drawn or bent out of shape by the tension of the pole strap.

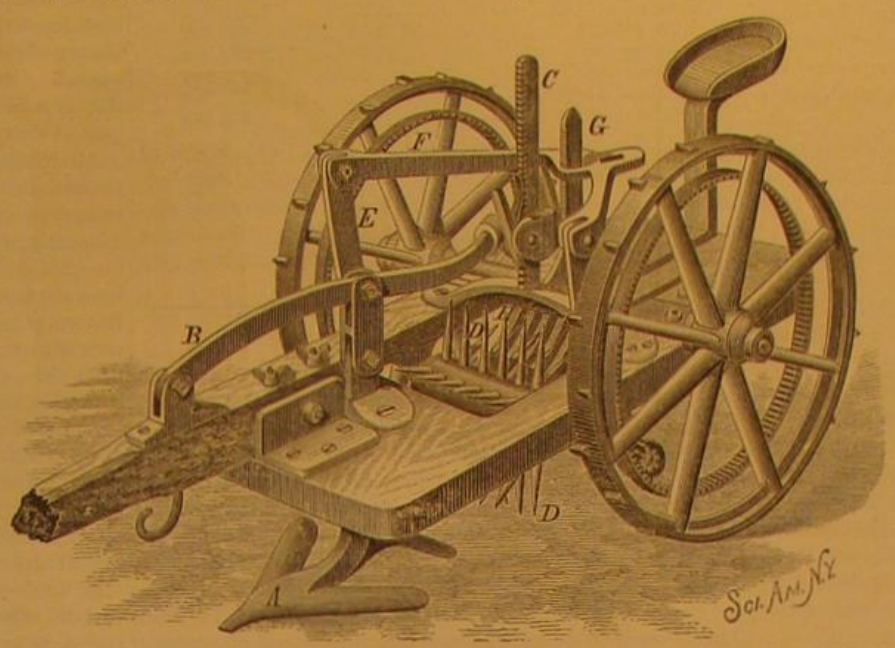
Mr. Wm. H. Hubbard, of Red Bank, N. J., has patented an improved Gate, which consists of metal or wooden bars supported at one end in a post having a friction roller at the bottom running on a rail, and at the opposite end entered into metal or wooden tubes placed in or constituting the adjoining panel of the fence, so that when the gate is opened the rods of which it is made slide or telescope into the tubes of the adjoining panel.

A NEW POTATO DIGGER.

We illustrate herewith a novel potato digger recently patented by Mr. H. Strait, of No. 18 Sixth St., Troy, N.Y. Its new features will be readily seen by reference to the engraving. The plow, A, which runs under the potato hills, has a vertical standard that runs upward through a guide in the frame, and is connected by links with the lever, B, which is fulcrumed on the tongue. The free end of this lever passes through a slide that carries a spring latch, and is movable on a vertical standard, C, that is supported by the machine frame. Behind the plow, A, there is a toothed cylinder, D, that is journaled in two arms, E, pivoted to opposite sides of the frame. The cylinder, D, as well as its teeth, are of hard wood. The ends of the cylinder shaft carry pinions that are engaged by internally toothed flanges on the inner faces of the drive wheels. The upper ends of the arms, E, are pivoted to a fork having two mortises, either of which may be placed over the standard, G. By means of this fork the pinions of the tooth cylinder are thrown into and out of gear. Behind the toothed cylinder there is a series of curved tines, H, which alternate in position with the teeth of the cylinder, D.

As the machine is drawn forward the earth is loosened by the plow, and the potatoes are separated from it by the revolving toothed cylinder. The tines, H, prevent the vines from winding on the cylinder, and also prevent the potatoes from being thrown upward by the teeth. It is claimed by the inventor that the machine is very effective in its operation.

For further information address the inventor as above.



STRAIT'S POTATO DIGGER.

THE MANUFACTURE OF LARD.

American refined lard, as an article of export, will overreach the round sum of $30,000,000 per annum, ranking the sixth in value out of $600,000,000 of American exports. It is exceeded only by cotton, breadstuffs, petroleum, tobacco, and bacon.

The American lard of the brand of "W. J. Wilcox & Co.," made in New York city, has received the gold medal at the Paris Exhibition for its excellence, being the only gold medal awarded for lard. It was given for uniformity of color and body, sweetness, and superiority of preparation for exportation. The annexed engraving represents the lard exhibit of W. J. Wilcox & Co. at the Paris Exhibition.

At the Centennial Exhibition the company received the highest award and prize medals for the purity of their various productions.

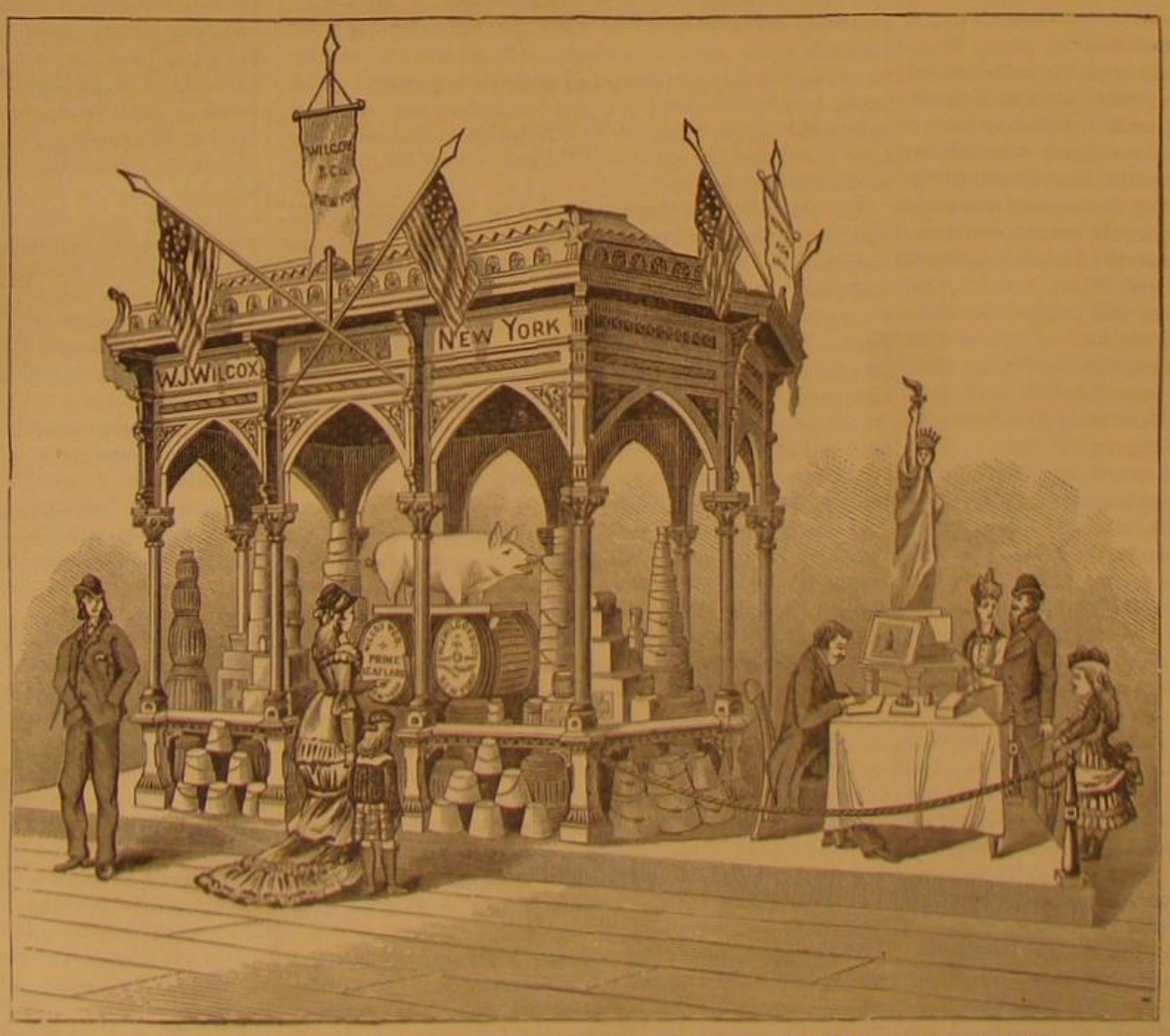
It is said that the Wilcox lard forms about one half of the entire shipment of that commodity from New York; and of the nearly one and a half million tierces annually exported from the United States, two thirds of the total amount go from the metropolis. This immense foreign demand gradually increases every year, and the domestic consumption constantly grows larger.

Though still doing business under the original firm name of W. J. Wilcox & Co., the concern has, for several years, been an incorporated company, with the following officers: Mr. William A. Cole, President; Mr. Samuel E. Hiscox, Vice-President; Mr. E. T. Bell, Treasurer. The entire stock is owned by these gentlemen, who are virtually in copartnership.

The refinery of this concern is very extensive, covering a large area of the block bounded by Greenwich, Washington, and Vestry streets. There are also extensive premises in West Twelfth street. Altogether there are about three hundred workmen employed. The works are completely provided with the most approved modern machinery, of which the company are the inventors and owners.

The crude material, which is constantly arriving, is most rigidly inspected, and any portion of it that fails to meet the required standard of taste, color, and consistency, is promptly condemned and removed. The approved stock is then emptied into enormous kettles, some of which have a capacity of 75,000 lbs. The kettles being filled, sufficient heat is applied until the mass is thoroughly cooked, after which it is transferred to coolers. At this stage of the process certain methods peculiar to the Wilcox Company are applied, which render the lard white, sweet, pure, and uniform in texture and quality. The next process is to run it through the pipes into huge tanks placed in the sub-cellars. Thence it is drawn off in vessels varying from a 1 lb. tin can to a 320 lb. wooden tierce. All these packages, when filled, are carefully cleaned from all outside drip; they are then weighed and branded—the smaller sizes being packed in cases. It is stated that there is not a country in the world to which the refined lard of Wilcox & Co. does not go; there is not a commercial city in continental Europe in which its price is not specifically quoted each day, to the exclusion of all other productions; and the manufacturers assert there is not an instance known of a shipment having been defective in quality, short in weight, or in any degree of perfection below the standard.

The offices of the concern are located at 41 Broad street, New York city, and are in telegraphic communication with the works. A wire connecting with the Western Union Telegraph Company's main office delivers domestic telegraph advices, and cable news from all parts of Europe.



W. J WILCOX & COMPANY'S EXHIBIT AT THE PARIS EXHIBITION.

Superb Photographs.

We are indebted to F. Gutekunst, the well known photographer in Philadelphia, for copies of excellent photographs of the late Bayard Taylor and Morton McMichael. The former was the American Minister to Berlin, and the latter, the proprietor and editor of the *North American* Newspaper.

THE shipment of American oysters to England is now carried on to the extent of from 1,200 to 1,500 barrels a day. On December 7 nearly 2,600 barrels were shipped for the Christmas trade.

Preservation of Butter.

The Italian Minister of Agriculture, Industry, and Commerce has addressed a communication to the Chamber of Commerce of Milan relative to the renewed experiments in salting butter with borax which have been carried out at the Agricultural Station at Florence. From the account which appears in our contemporary, the *Giornale di Agricoltura*, borax would appear, says the London *Grocer*, to have a most marvelous effect in insuring its absolute preservation. Samples of fresh butter made at the Florence station, and purposely not carefully freed of their buttermilk, were found, on the addition of about 8 per cent. of borax, to maintain their natural fine flavor without the least change whatever for upwards of three months. To attain this satisfactory result it is necessary that the borax should be perfectly dry and in very fine powder, and care must be taken to insure its thorough mixture with the whole mass of the butter operated on. Among the further advantages of this plan, it is noted that borax imparts no flavor of any kind to the butter, while it is entirely harmless in its nature, and also reasonably cheap. Still later experiments have shown that a very much smaller proportion of borax suffices to produce the desired effect, and, also, that simple solutions of the salt act quite as well as the dried powder.

[We cannot recommend our agriculturists to enter largely into the substitution of borax for salt in butter for house use, but it may be well for some to try the experiment on a small scale.

The consumers on the Continent are averse to salted butter, and likely they may prefer borax as a preservative, while our people will adhere to their salt.—ED.]

To Render Wood Incombustible and Impermeable.

According to the *Timber Trade Journal*, M. M. P. Folbacci claims to give these properties to wood by means of the process described below. It thus becomes petrified, so to speak, without, however, undergoing any change of appearance. On being subjected to intense heat it becomes charred on the surface, but very slowly and without any flame, and it is only necessary to scratch the surface to find the substance of the wood intact. Hence in case of fire, the firemen would have no occasion to fear that the materials on which they tread would give way beneath them, if this operation has been undergone by the wood composing staircases, floors, etc. The following chemical compound is said to produce the result: Sulphate of zinc, 55 pounds; American potash, 22 pounds; American alum, 44 pounds; oxide of manganese, 22 pounds; sulphuric acid of 60°, 22 pounds; water, 55 pounds. All of the solids are to be poured into an iron boiler containing the water at a temperature of 45° C., or 113° F. As soon as the substances are dissolved the sulphuric acid is to be poured in little by little, until all the substances are completely saturated. For the preparation of the wood it should be placed in a suitable apparatus, and arranged in various sizes (according to the purposes for which it is intended) on iron gratings, care being taken that there is a space of about half an inch between every two pieces of wood. The chemical compound is then pumped into the apparatus, and as soon as the vacant spaces are filled up it is boiled for three hours. The wood is then taken out and laid on a wooden grating in the open air, to be rendered solid, after which it is fit for uses of all kinds, as ship building, house building, railway carriages and trucks, fence posts, wood paving, in short, for any kind of work where there is any liability to destruction by fire.

Mining Notes.

As mining investments continue to attract increasing attention in the East, New York is becoming the great mining exchange of the country, where the idle capital of the East, seeking investment, and the mineral riches of the West and South seeking development, meet to build up enterprises that

in the aggregate promise in a few years to add more to the wealth of the country and give more profitable employment to labor than any other one industry now pursued here.

There is scarcely a good mining property that is not now represented in New York, and there is hardly a newly discovered mine east of the Pacific coast range that does not seek for capital here.

It is unavoidable that some purely speculative enterprises should be offered side by side with legitimate ones, that some swindling operations should be successful; but the means are daily multiplying, the system is daily improving, whereby it will be possible to give to each its rightful rank, so that proposing investors may make their choice.

Southern gold mines are now attracting much attention, and it is reported that eleven of the North Carolina and Georgia gold mines were sold to New York parties a week or two since, and that contracts are being negotiated for many of the best mining properties in these sections.

From the Eagle Gold Mining Co., Strafford county, Virginia, comes a report that the vein is from 14 inches to 6½ feet thick, and that the shaft has been sunk 160 feet. Before the war it is said the mine yielded 13 ounces of gold for every $25 paid for wages; now it yields 16 ounces for the same outlay. The Findley Mine, Georgia, has just paid a small dividend, and expects to pay another this month, from surplus earnings. A number of individual enterprises in the South are reported as doing well on the capital invested.

The profitable development of the majority of the Southern mines would have been impossible a few years ago; improved machinery and processes and mining knowledge gained by costly experience have, however, made these and many poorer properties present good investments.

The Homestake Mine, of Dakota, covering 1,350 feet by 450 feet on the mineral vein, has ordered 120 stamps for spring work in addition to the 80 now in operation. The present gross production of the company is about $60,000 per month, and regular dividends seem to be assured for a long time to come.

The silver production of Leadville, Colorado, exceeds all expectations, and new discoveries are daily reported. The product of the leading mines has increased 50 per cent within the past few weeks. Two thousand tons, yielding 20,000 ounces of silver, were delivered last week, and 3,000 tons of high grade were awaiting transportation. It is estimated that the product of the camp for the year 1878 will reach $3,000,000.

In Idaho placer mining on the Snake, Boise, and Fayette rivers and their tributaries is being vigorously resumed, because of recent improvements in processes for securing the fine gold, and most satisfactory results are anticipated. The working mines of Idaho are, in general, doing well.

The Ontario Silver Mining Co., of Utah, since the commencement of operations in September, 1874, has paid in dividends to stockholders $1,900,000, and its development is still progressing. The Stewart Gold Mine, located in the Bingham district, has been incorporated with capital stock of $6,000,000, and the results of its workings are thus far so satisfactory that additional stamps are being erected.

Several valuable quartz claims have recently been discovered in Calaveras and Tuolumne counties, California, promising to be richer than any preceding discoveries, and a revival of prosperous times is confidently anticipated there. From many other counties in California cheering accounts of mining conditions are received from Mono, Amador, San Bernadino, Contra Costa, and others, and everywhere there is evidence that we have much more to learn of the mineral wealth of the State. The Idaho Mine, of Grass Valley, Cal., yielded $47,000 worth of gold in October, and the 111th dividend was paid, making a total distribution of $2,510,000. In 1870 this mine was offered in England for £20,000.

Nowhere are richer ores found than those constantly reported from Arizona, and so important are the mining interests there now that it cannot be long, we think, before some way is discovered to escape from dependence on San Francisco reduction works.

The Comstock Mines, of Nevada, are with scarce an exception promising better returns than for many months past; but as public faith in them departed with the late disastrous stock speculations in San Francisco, other mines are preferred for investment.

At no time has there been so universal an interest in mining enterprises as is now manifest in every direction. The snags and quicksands having been well defined by their predecessors, the miners and investors of to-day need only to exercise ordinary caution to safely arrive at desired results.

THE YIELD OF PRECIOUS METALS IN 1878.

Wells, Fargo & Co.'s annual statement of the precious metals produced in the States and Territories west of the Missouri River, including British Columbia, and the receipts in San Francisco from the west coast of Mexico during 1878, show the aggregate products to be as follows: Gold, $38,956,231; silver, $38,746,391; lead, $3,452,000—the total being less by $17,267,132 than for 1877. California shows an increase in gold of $2,068,000, but a decrease in silver, etc., of $1,323,000. Nevada shows a total falling off of $16,398,341, the yield from the Comstock being only $21,295,043 as against $37,911,710 for 1877. Montana shows a marked increase, all in silver. Utah shows a falling off of over $2,000,000, but nearly $1,000,000 of it is caused by reduced valuation of silver and lead bullion. Although Colorado shows $1,680,802 less than for 1877, the yield has been really greater, as the reports for 1877 duplicated the product of certain localities, but the duplication was not discovered soon enough to be corrected in the statement for that year. The production by States and Territories is as follows:

California	$18,920,461
Nevada	35,181,949
Oregon	1,213,724
Washington	73,311
Idaho	1,868,122
Montana	9,763,640
Utah	6,064,613
Colorado	6,232,747
New Mexico	453,813
Arizona	2,287,983
Dakota	2,215,804
Mexico (west coast)	1,594,995
British Columbia	1,283,460

The bullion from Comstock lode contained 45 per cent of of gold and 55 per cent of silver. Of the so-called base bullion from Nevada, 30 per cent was gold. Of the whole product of the State, 35 per cent was gold. It is probable that the yield of gold and silver from all sources named for 1879 will not greatly exceed $70,000,000.

Correspondence.

The American Middlings Purifier Company.

To the Editor of the Scientific American:

In your last number you quote, with a head note indicating entire sympathy, an article from the *American Miller*, which records two decisive defeats recently sustained by the American Middlings Purifier Company—one before Judge Blatchford, against Vail, Shotwell & Co., and one in Richmond, Va., against the Haxall-Crenshaw Company.

Now as to the facts. In the case of Vail, Shotwell & Co., Judge Blatchford granted the injunction instead of refusing it, the difference being that the plaintiffs prevailed instead of the defendants. It might be of interest to you to know more of the particulars concerning this decision. The case was before the court upon an interlocutory motion for an injunction, not upon the final hearing. The defense was conducted by the Millers' Association, it paying the expenses for experts, attorneys, etc. The argument was thorough and exhaustive, continuing through several weeks, as it was a test case for that circuit. After this elaborate argument the case was taken under advisement, and before the judge had prepared his opinion the defendants filed an *ex parte* suggestion to the effect that they had become insolvent and did not intend to resume the manufacture of flour, and withdrawing objection to the issuing of the injunction as prayed for.

The decisive victory achieved by the defendants was, that by this timely surrender they prevented Judge Blatchford from filing an opinion sustaining the patents. The bad faith of their course is apparent from the facts that the suit, although in form against Vail, Shotwell & Co., was really a test case against the Millers' Association; that the defendants were no more insolvent when the surrender was made than when the case was argued; and that the expenses incurred by the Association far exceeded any damages which could have been recovered in the particular case. In other words, this is only one of the tricks by which infringers hope to exhaust the purse and the patience of the patentee whose rights they ignore.

The other decisive victory is found in the fact that a bill was filed against the Haxall-Crenshaw Company, and an answer put in; there it rested. Some months ago the defendants obtained an *ex parte* rule on the plaintiffs to file security for costs or show that they were carrying on business in the State. The rule not having been served on the plaintiffs, and their attorney having no knowledge of it, the cause was dismissed for non-compliance. Of course such an order would be set aside upon motion, but no evidence having been put in upon either side, the plaintiffs preferred the less troublesome and less expensive course of filing a new bill, the costs being about $12.

It is upon such chaff as this that the milling journals feed their subscribers, and from which they manufacture great triumphs; because they are the organs of the millers' associations, and these associations must constantly stimulate their members to pay their subscriptions, which are for the avowed purpose of resisting payment for any patent, of any kind, for any purpose, connected with their business.

Why the Scientific American should sympathize with these objects I cannot understand. They are simply combinations of manufacturers who extensively use patented machinery to defeat the claims of all patentees.

If you think that the so-called "Cochrane ring" is composed of such bad men, or has pursued such an evil course, or owns such vicious patents as to place them outside of ordinary laws and rules, I would be glad to disabuse your mind in those particulars.

The whole of their offense is that they hold patents which are being infringed in several thousand mills. The infringers are numerous, influential, and arrogant. They act upon the maxim adopted by other powerful combinations, that it is cheaper to fight patents than to pay for them.

I send you a list of the persons who compose this company. A very little inquiry will satisfy you as to who and what they are.

The course pursued by them has been to endeavor to collect a very small compensation for the use of their patents. When this was refused they sued an infringer of large wealth who was well able to defend himself, and who owned adverse patent interests of great value. The case was tried and the Cochrane party were beaten. Thereupon they appealed to the United States Supreme Court, where all of their positions were sustained and the patents fully vindicated. They renewed their efforts to obtain from millers about one hundredth part of what would be due on a strict accounting. The charge was then made that the former decision in their favor had been obtained by collusion. This charge they promptly met, and the Supreme Court, after a thorough investigation, reiterated its opinion as to the validity of the patent, and said, "We see no ground to believe that the appellants are chargeable with any collusion with the appellees in this case in reference to the argument of the appeal. On the contrary, the weight of the evidence is that they repelled any arrangement or proposition which might look to that end."

All compensation having been denied them, they commenced suits against about half a dozen parties who were representative men, and one or more of these suits have been diligently prosecuted for the purpose of finally settling every question which it was alleged had not already been passed upon by the Supreme Court. All the others of the milling fraternity have been left undisturbed, unless it be by their own consciences. No miller who has offered to settle, even upon the most absurdly low terms, has had his offer refused.

Mr. Cochrane, the inventor and patentee of this new process, found that he was utterly powerless to cope with an army of infringers; he, therefore, associated with him a few persons who could provide the means for carrying on the expensive litigation which must ensue unless he abandoned all of his rights. Out of this has grown the cry of the "Cochrane ring."

If the inventor stands alone, he is pushed aside as of no account whatever. If he obtains assistance to vindicate his rights, he is met with the cry that an infamous ring is trying to oppress and plunder the poor manufacturers.

In sober truth, the persons denounced in the article you quote are fighting not their battle alone, but the battle of all inventors. If they should conclude that the odds against them are too great for successful resistance, and give up the unequal contest, what will have been gained and lost? Merely this, that the story of Whitney and his cotton gin will be once more repeated, and the rule again established that the more valuable an invention is to the public, the less beneficial it is to the inventor. If a person devises something which meets the wants of a multitude of persons, they can help themselves to the fruits of his labor and combine to resist any demand for compensation, however moderate, and ruin him by litigation in which he must bear all of the expenses of one side of the contest, while those of the other side are divided among several thousand.

It is a mistake to suppose that these combinations are directed especially against the Cochrane patents because there is something exceptionally obnoxious about them. They are merely associations of those engaged in an important branch of industry to resist by their joint action all attempts to compel any of them to pay for the use of any patent. These particular patents are more extensively infringed than any others, and therefore the opposition to them forms a bond of union for a larger number of persons who are animated by this spirit.

A candid examination of the facts will satisfy you that there was never a case where the owners of a patent had better grounds for believing in the entire justice of their cause, where their demands were more moderate or have been urged in a greater spirit of forbearance and conciliation.

Of course it is within the limits of possibility that the Cochrane patents are invalid, or that some of the parties we have sued do not actually infringe them. These are the chances of litigation which we must take; but what we protest against is that a body of men, who are charged with being infringers, should by "damnable iteration" be able to induce those who are in the main friendly to patents to believe that there is something disreputable in a patentee associating with him honorable gentlemen, for the purpose of asserting his rights and vindicating his patents against those who are too strong for him to resist single handed.

Very respectfully, your obdt. servant,

CHAS. F. PECK,

Secretary of the American Middlings Purifier Company.

Washington, D. C., Jan. 6, 1879.

Steam for Thawing Frozen Earth, etc.

To the Editor of the Scientific American:

As you suggested the use of steam for thawing frozen ground, I thought you might feel interested in the following experiments.

The chief of our fire department recommended the construction of a portable boiler, with a suitable nozzle and tube connection, for thawing out the fire plugs. He also stated that it would be useful in excavating trenches for repairing service branches. The city plumber did not believe that it would be. Both were positive, and a wager and trial were the result.

A nozzle of ¾ inch gas pipe, reduced to ¼ inch at the point and formed like a cross at the top, for convenience in handling it, was attached, by rubber hose, to the boiler used for heating the water in the steamer of Company 1. In 30 minutes after steam was first turned on they had a hole 8 inches by 12 inches through the frost. Steam was used at about 35 or 40 lbs. There was one inch of frozen snow on the bricks, and the ground was frozen for a depth of 2 feet. The thermometer stood at -6° in the morning, but had risen to 15° above zero at the time of the trial. The hose coupling parted twice, which caused the loss of a few minutes.

Newport, Ky., Jan. 10, 1879. C. P. B., Jr.

AMERICAN MECHANICAL GENIUS.

BY W. J. STILLMAN.

The World's Fair, lately closed, has, like the previous ones, been a great triumph for American inventors. The victory was so clear and so remarkable that one might say, as in the yacht race, where the America won her blue ribbon, that no nation was second. The case has given rise to some discussion, and the London *Times*, in its editorial comments on the subject, takes the simple and comprehensive ground that the admitted superiority is due solely to the necessity of providing for deficient labor by mechanical contrivance. This would be a satisfactory solution, *to Englishmen*, if it could be maintained; but, unfortunately, it does not account for the facts; it is a plausible but incomplete theory, that would account for many new inventions, but not for the better workmanship which makes so many new inventions possible and successful in America which are not so in England. A simple and well known case which negatives the *Times'* theory is that of the revolver. No one can say that the necessity which incubated pistols sat more heavily on America than on the older and military states of the world. Moreover, the revolver has been invented at least two centuries, and may be found in various forms in all the collections of mediæval arms in Europe. No English gunsmith who studied his business properly, should have been unacquainted with this old weapon. Only, it seems never to have been a success. The reason of its revival in America was simpler than the *Times'* theory: the quality of the workmanship employed on it was such that a perfection of adaptation of the mechanism which revolves the cylinder was possible, and the operation of it became automatic and infallible.

One can hardly say that a more dire need of telegraphic operation obtained in America than in England; in point of fact, an imperfect system of communicating by electricity was used in England before Morse turned his attention to it. Morse was driven by no necessity to use a telegraph—probably cared less for the actual benefit of the invention than any operator in cotton even at that day. But he saw the imperfection of the appliances, and invented the relay magnet which made the recording of an electric impulse possible. And to this day the majority of all improvements in telegraphing are invented in America. There is here no question of carrying labor where it is most wanted by mechanical appliances, for the greater need, if that can be called need which created its own demand, was on the other side of the Atlantic, to say nothing of the greater number of scientific investigators.

England had a large army and pretty constant occupation for it, somewhere, which did not prevent Englishmen and the English government from going on with the old system of making guns by hand, and clumsily, until from the American machine shops was turned out the mechanism which set Enfield going on a new basis. The Waltham watch works are another case in point. A large portion of the mechanical intelligence of England was employed in watch making, and it still is so, but the watch made by the Waltham workman, without any novelty in invention, is a better watch, at a given cost, than the English. When Whitworth came to America to study the American system of rifling small arms, he found no new principle applied or variation in the general design from English rifles, but he found a precision of workmanship which few men in England, besides himself, had the mechanical *finesse* to appreciate. The external differences were very trivial, and generally the English gun showed a luxury of mere finish which quite shamed the rough American gun; but I never knew an Adirondack hunter, in my hunting days, who would accept an English rifle as a gift on condition of habitually using it. Yet the English gun cost, on the average, five to ten times as much as the American, while, for practical result, it was not to be compared to it.

The difference in every case was in the fact that a higher grade of mechanical intelligence was employed by the American—a keener and finer perception of what fitted the case—a mental micrometer which discovered hundredths where the Englishman's only found units. This, of course, Englishmen in general will not admit, but it so happens that I have often had occasion to employ good English workmen in England, and I have invariably found that in the intelligence to apprehend fine degree of fittingness, precision of shaping, and especially capacity to catch a new idea, the Englishman was far inferior to the American. I remember a case in point, which I will relate in detail, as it is characteristic. In a journey from New York to London I had lost out of my valise a small swage for shaping and compressing the conical bullets for a hunting rifle I carried with me. It was a simple affair, a bit of steel bar bored into a couple of inches, and then at the bottom of this drill hole the conical reamer which shapes the shot is sunk its full depth. A plunger, driven down by a hammer, forms the base of the shot and compresses it. The whole cost, in New York, $2. To replace it I went to all the gunsmiths between Regent street and St. Paul's, but could not find one who would undertake it, until finally I was directed to a high class workman who had a small shop and worked for the larger manufacturers. I explained my want to the minutest operation, gave him a sample of the missile to work from, and at the end of three days, employed in failures, he brought me a curious affair made by turning out in a lathe the form of the shot in a kind of die, which was then tapped and screwed into a tube made of a piece of gun barrel of the requisite bore, to which was added the plunger. He had not in the least understood my description and drawing, and could not conceive any other way to make the thing than that he had employed. Of course it split at once under the pressure and had to be thrown away.

I am myself sometimes attacked by a mechanical idea, and now and then it results in an invention. It happened that one one occasion the product was a photographic camera obscura, which involved some mechanical principles new to this kind of work. I made an elaborate working drawing full size, with details of all new parts in separate drawings, and sent them to a camera maker who had the highest repute in London, but after some months they came back with a message that the arrangement was not practicable. I then went personally with the drawings to another workman, who was really the most ingenious in this branch I ever found in England, and even with him was obliged to make a wooden working model of the whole thing before I could make him see that it would work, and I had to watch the construction from beginning to end, intervening at every new step to keep it what I had planned.

At another time I had got from America a piece of apparatus which I wanted copied. An important part of it was a very light bronze bed plate, rather complicated for a casting, but in the American article done well and cheaply. The manufacturer to whom I took it looked at it in admiration and dismay. "I can't get casting like that done in this country," said he; "there is not a founder in London who can do it," and he was obliged to substitute sheets of brass screwed in place and supported by wood.

A still more convincing case has lately occurred in my experience. I have a Remington gun, to which I wanted some additions made, and sent it, being on the Continent, to the Remington establishment in London, where English operatives are employed. After the characteristic delays, which I never found wanting in English workshops, the gun came back to me with the desired alterations, but done in a clumsy and uninventive manner, which any ordinary American gunsmith would have been ashamed to send out of his workshop. Yet here was, or was supposed to be, the American intelligence presiding. I have had the same things done at home at half the cost, and in a manner which left no ground for comparison.

These are instances of what I have seen many times. The English workman in general is insensible to those nice degrees of excellence, neatness, and precision in the manipulation which the American workman catches so readily.

The success of American invention, in my opinion, is due to the highest excellence of the mechanical manipulations by which they are worked out—an excellence compared to which French work generally is flimsy and English clumsy—the former gives way, and the latter is not exact. I know Englishmen of extraordinary mechanical genius, but their most ingenious ideas are carried out at Paris.

But if the success of invention is due to the finer grain of the workman's brain, the invention *itself* is due to other qualities more multiplex and less easy of being demonstrated. First, I believe, is the freedom from deference to precedent which characterizes the American character in every branch of activity. This, of course, is due simply to position. We had no precedents, except such as it was impracticable to follow, and the habit of having none has liberated thought in every way. The contempt for authority, which in excess proves so often disastrous in our politics, is an almost unmitigated advantage in all mental processes except the purely artistic. The American in his better development gives that devotion to law which the Englishman gives the authority; but the law is universal in its application, while authority is narrow and restricted to what has been done. This distinction imbues the whole national character. The Yankee if menaced with arrest wants to see the warrant; the cockney accepts the mission of the "bobby" without any other demur than perhaps to look at his number.

But still behind these qualities lies the essential inventiveness—an intensity of imaginative vitality which is in the composition of the composite race which we are, the power which in art and poetry has held and will always hold the world in reverence, and which had such a glorious sunrise in Greece from Homer to Praxiteles, the power which no man can explain and no man can acquire, which seems to come to man or nature without antecedent or succession, and of which we know mainly that it generally goes in schools. There is a curious and close likeness between the character of the Greek and the American, which goes even into the type of the physique, and which I have heard often noted in Greece, both by Greeks and foreigners. This very element of imaginativeness is one of the strongest components in the similarity of the national characters. It will be curious for those who will be here to see it, to follow out the parallel which certainly does now exist and that which will obtain between the republican Greek of 700–500 A.C., and the republican Yankee who will exist about 2000 A.D.

So far as England is concerned there is a negative element which is disastrous for the development of invention in that country in the patent law system, perhaps the worst that exists in any state in Europe—worse, actually, than none at all.

I have had some personal experience with it, and feel justified in saying that I do not know which is worst, the scheme of law, the manner in which the patent officials do their duty, or the curious ignorance of all principles of mechanism shown by the judges who sit for the decision of patent cases. Neither the legislative nor the judicial authorities seem to be able to understand the interests, not of inventors merely, but of invention.

Labor Troubles Abroad.

The ship builders, mine owners, iron workers, and in fact nearly all the manufacturing industries of Great Britain, find it imperative to reduce the prices of labor in their various establishments. This produces an uneasy feeling throughout most of the manufacturing districts of England, and the American *Architect* thinks it looks as if the battle so portended were likely to be one of the severest of the labor war. However it may end, it can hardly be other than disastrous. The iron trades in Great Britain are now in an exceptionally critical condition, owing to the successful competition of other countries, particularly of the United States, and the coal trades necessarily suffer with them. If the men succeed in the struggle in either trade—or in both, for it is likely that they will succeed or fail together—they will succeed in adding a heavy load to an industry that already shows symptoms of paralysis. If they fail, they will still have done by forced stoppage an injury to their employers of which they must themselves feel the burden; but they will waste a great part of their own strength in the conflict, for they will probably not give up early. The funds which they have laid up for the relief of the disabled among them, or of the families of those who die, will be eaten up very fast, and in spite of this the hardships which it was their purpose to avoid will have been increased. It might have been hoped that the fortune of the Oldham strikers, who, having in a few weeks spent more than a quarter of a million dollars in the effort to force their employers to pay them wages which the condition of business would not allow, found themselves obliged to yield, would have made other unions slow to follow their example. But there is not much hope of avoiding the waste and injury of strikes so long as working men are taught or allowed to look upon every diminution of wages as an oppression. Their greatest benefactor just now would be he who should teach them that no class in a community can expect to be exempt from the suffering and loss of a period of general adversity, and that to strive against such loss with violence is to kick against the pricks; and should moreover lead them to look for comfort in the doctrine that even a fall of wages does not necessarily mean a loss of comfort when the cost of living goes down with them.

American Reapers and Binders in New Zealand.

From the New Zealand *Country Journal*, a monthly publication devoted to agriculture, pastoral, and horticultural pursuits of New Zealand, we learn that our reapers and binders are finding their way into that far away colony. At present, so far as we are aware, says the *Country Journal*, there are six different self binders in the American markets, viz., the McCormick, Wood, Osborne, Marsh, St. Paul, and Buckeye, each claiming superiority over its fellows. With regard to the merits of the several machines as yet imported, it is not the province of this paper to express any opinion in favor of any of them. The farmers of the country must be the judges; time only can decide which is really the best, although there is no reason why one may not be quite as good as another. So far, those in use have their several admirers, and doubtless each has its own peculiar merits. As yet the trials have not been sufficiently varied or numerous to justify any fixed opinion of any value, which would laud one maker's machine over the others. As we have just remarked, time and the farmers themselves will decide. At the conclusion of next harvest the country will be in a better position to judge. The only objection, adds the writer, and the same we believe prevails here, which we have heard raised against these machines is, that the wire cannot be kept out of the straw, and that it will prove detrimental to horses and cattle, when cut up with the chaff.

What Civilization and Invention Do.

One of our daily newspapers said the other day, just after recounting a series of disasters, that there seems a fatal quality belonging to every one of civilization's conveniences, inventions, and improvements. The aboriginal Manhattan was safe if not always comfortable in his wigwam. Our houses serve as man traps, burning or crushing out scores and hundreds of lives annually. Our elevators fall and kill their inmates. Steam boilers in the next building, of whose existence we are not aware, suddenly explode, mangling and scalding people not previously aware of their existence. The locomotive averages over a victim a day "killed on the track." Gas leaks accumulate and explode, smashing people and furniture. Drawbridges lure people to tumble into the water and drown. New chemicals used in manufactures explode with terrific force, and nobody is left alive to tell what it was or how it ignited. Even fine flour siftings and pulverized starch are regarded as suspicious characters full charged with explosive and deadly intent. Ice making in range and water pipes converts them into engines of destruction. Though sewers carry off filth, they also extract its deadliest essence and send it back into our houses as "sewer gas." Civilization is full of peril. The original Manhattanese had not to incur these daily risks of our lives.

COATING COPPER PLATES WITH IRON.—Prof. Böttger recommends the following solution for coating copper plates with iron: Ten parts of ferrocyanide of potassium and twenty parts of tartrate of soda are dissolved in 220 parts of distilled water, adding a solution of three parts of sulphate of iron in fifty parts of water. Caustic soda solution is poured into the mixture until the Prussian blue formed is redissolved.

ATMOSPHERIC AIR AND THE VACUUM.

The origin of the first pneumatic apparatus, the syringe, is unknown. The fact that the piston of the syringe could not be withdrawn without the cylinder becoming filled with air, water, or some other liquid, constituted one of the experimental proofs of the theory of the "*horror vacui*" accepted by ancient philosophers. The Greek observed that combustion, taking place in a vessel rarefied the air. By means of the introduction of a burning light into a bell-shaped vessel and then pressing the latter to the skin, they applied cupping glasses in the same way as it is done at the present day. This being an inconvenient method, however, they looked for some different means. Hero, of Alexandria, in the 56th chapter of his celebrated "Treatise," describes "the construction of a cup sucking without the aid of heat." The closed end of this cupping bell was separated from the mouth by a transverse partition situated near the latter. Into the closed end was inserted a tube with a stopcock. The partition also was provided with a valve, by which the two compartments could be brought into communication at will. With the valve between the compartments shut, the air was sucked out of the upper compartment through the tube, and the stopcock closed. The bell was then applied firmly to the skin, and the valve opened; the air within the entire bell was thus rarefied, and the skin consequently raised by aspiration.

This same idea was brought out, after a lapse of many centuries, by Otto von Guericke. He used a hollow sphere with tube and stopcock, from which the air was removed by a pump. Otto von Guericke, born in 1602, was burgomaster of Magdeburg, in Germany, and spent his hours of leisure, which his duties as a public officer and his frequent diplomatic missions allowed him, to study and experiment on scientific matters. His attention being first called to the problem of creating an entirely empty space by a treatise on that subject, he set out to experiment at once. He tried, at first, to remove the air from a tightly closed cask. For this purpose he used a pump, provided with the necessary stopcocks, reaching to the bottom of the cask. The latter being filled with water, he commenced to work the pump, but as he removed the water the outside air forced its way into the cask by minute openings in the wood, causing a noise as if the water within was boiling. He next used a hollow sphere of copper provided with a tube and stopcock, which was screwed airtight to a powerful pump, after being filled with water. It required two stout men to operate the pump and remove the water. Then the stopcock was closed and the copper globe detached. The stopcock being now opened, the air rushed into the hollow sphere with such force that anything coming within reach was caught by it, and the hand held over the opening was severely injured.

These experiments were repeated at Ratisbon, in 1654, before the German Diet, the Emperor, and the most celebrated statesmen and scientists. The Archbishop of Mayence became so interested in them that he induced Otto von Guericke to leave Magdeburg and bring his apparatus to his palace at Würzburg. At the latter place the celebrated mathematician Schott, a Catholic priest, and several other *savants*, assisted Guericke.

The latter's researches obtained publicity for the first time under the title of "The Magdeburg Experiments," in Schott's work, "Ars Hydraulico-pneumatica," and later, by introduction, into the work of the same author, "Technica Curiosa" (lib. i., "De Mirabilibus Magdeburgicis.")

The book containing the most complete account of the discovery, however, was published in 1672, at Amsterdam, under the title "Ottonis de Guericke Experimenta Nova (ut vocantur) Magdeburgica, de Vacuo Spatio," of which the author is unknown. The pneumatic machines were not very portable, and as Guericke wished to repeat all his experiments in a comprehensive way before his sovereign, the Elector of Brandenburg, he constructed an apparatus possessing a marked improvement on his former machines.

It consisted of a vertical cylinder of brass or iron, supported by a tripod made of iron (Fig. 1). At its lower end the cylinder had a stopcock, while within a piston and rod could be moved up and down by means of a stout lever fastened to one of the legs of the tripod. The piston was provided with a valve. On the upper extremity was

Fig. 1.—OTTO VON GUERICKE'S ORIGINAL AIR PUMP.

fastened a hollow sphere of stout glass provided with a tube and stopcock, similar to the copper globe previously used.

This machine being very exact and powerful, a prolonged series of experiments were then made. One of the most celebrated is that with the so called "Magdeburg Hemispheres," used in schools at the present day, and constructed substantially the same as those made by Guericke. They consist of hollow brass hemispheres, as shown in Fig. 2. The two hemispheres were pressed together and attached to the pump, by which a vacuum was created; when the apparatus was detached from the pump the two hemispheres adhered with great force.

After his first experiment with this apparatus, in 1656, Guericke stated that six powerful men could not separate the two parts. Afterwards, in 1657-64 ("Techica Curiosa," Schott), he said that a more complete vacuum was attained and the diameter of the sphere increased, so that he could hitch twelve horses to each side, and have them pull at their full power without being able to effect a separation. These experiments created a profound sensation. It was conceived gradually that it was the pressure or weight of the atmosphere that produced such astonishing effects. Calculating the pressure exerted on the surface of the two hemispheres, accepting the vacuum as perfect, we find it equal to the weight of a column of mercury of barometrical height, having a base with an area found by the formula πR^2, R being the radius of the sphere. The weight exerted will be $=\pi R^2 \times 76 \times 13{\cdot}6$.

A great variety of experiments were made. By allowing the air to enter slowly, by opening the stopcock slightly, the adherence of the hemispheres was rapidly diminished, and soon ceased altogether. Otto von Guericke said regarding this: "How is it, that a mere breath of air can accomplish what was impossible to do by the power of 24 horses?"

The separation may be effected also in a different way, of which the learned burgomaster did not think. When the hemispheres are joined together, and the vacuum within as nearly as possible complete, they are suspended under a glass bell, in which a vacuum is then also created. As soon as this is done the weight of the lower hemisphere will be sufficient to separate it from the upper one. Guericke attached one hemisphere to a hook fastened in the body of a gallows, and the other to a chain, running over pulleys, and carrying at the end a platform on which weights could be placed. When a sufficient load was placed on the platform the hemispheres separated, with a report similar to that of a cannon. Separation was also produced by men pulling on ropes running over a compound system of pulleys. Guericke also constructed an apparatus which he described as a "glass globe capable of moving 50 men against their will." It consisted of a cylinder resting on a support, and provided at the base with a coupling and stopcock. Within was contained a piston with a long rod. The piston was drawn out as far as possible, and the 50 men attached to the rod by ropes running over pulleys. To the lower end of the cylinder was now screwed a big glass globe previously deprived of air. As soon as the stopcocks were opened the air contained in the cylinder was suddenly diffused throughout the glass globe, thereby creating a partial vacuum in the cylinder. The piston was consequently forcibly drawn into the cylinder, while the men attached to the ropes were suddenly jerked forward in spite of their resistance. This experiment was afterwards modified by attaching the cylinder to a chain hitched to a platform bearing a great weight. When the air was removed from the cylinder, as shown in Fig. 3, the platform was lifted from the ground and held in suspension in spite of its weight.

Fig. 2.—ATMOSPHERIC PRESSURE EXHIBITED BY THE HEMISPHERES.

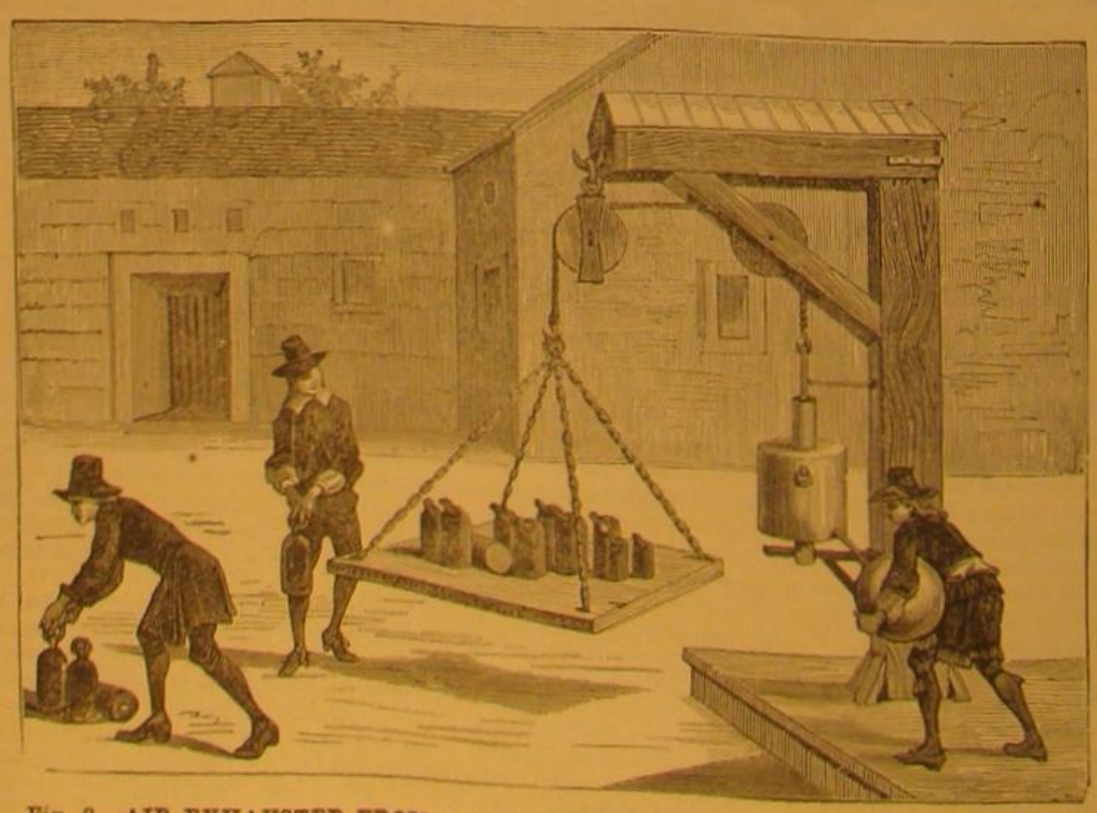


Fig. 3.—AIR EXHAUSTED FROM A CYLINDER BY MEANS OF A VACUUM BALL.

RECENT investigations indicate that the great kidney worm (*Strongylus gigas*) which exists in the kidneys of the horse, dog, and sometimes in man, lives in fishes in its young state; and the observations of Dr. Bertolus almost furnish proof that people contract the Swiss or broad tapeworm (*Bothriocephalus latus*) by feasting on imperfectly cooked trout. According to Professor Van Beneden, however, the latter parasite is at present known to occur only in Russia, Poland, and Switzerland. All full grown fishes sold in the shops as food are liable to contain entozoa.

THE PORCUPINE.

The porcupine is an herbivorous animal belonging to the order *Rodentia*, or gnawers, and the genus *Hystrix*. The latter comprises a large number of curious animals, which are distinguished principally by the long, horny spines which cover the larger portion of their body.

The porcupine is probably indigenous in the northern part of Africa. It was known to the ancient Greeks and Romans, who, it is supposed, introduced it into Europe. Aristotle mentions that the animal slept through the greater part of the winter. Pliny tells us "that it shoots off its spears like arrows."

Although the porcupine is, in reality, rarely over two and a half feet long, it seems to be much larger on account of the long spines covering it. The tail is from four to six inches in length, and its height at the shoulder is about one and a half to two feet. Its weight varies between twenty and forty pounds. The snout is short and broad, and the mouth is furnished with powerful incisors. The upper lip is very thick and provided with numerous long, shining black bristles. The neck is covered with long, flexible bristles, which may be raised or laid down smoothly at the will of the animal. The back is covered with sharply pointed spines of various lengths, which are held loosely only in the skin. Hence they are liable to fall out when the animal moves about violently, as for instance when defending itself. This has no doubt given rise to the story related by Pliny. Along the sides of the body the spines are shorter. The longer spines are quite flexible and about fifteen or sixteen inches in length, while the shorter ones measure about eight inches, being at the base about one fifth of an inch in thickness. In the interior they are filled with a spongy mass. Both the spines, as well as the bristles on the neck, are of a brown color, intercepted by white rings; the point and the root are also white. All the spines can at once be raised into an erect position by the contraction of a powerful muscle, which extends all over the back, directly under the skin. The belly is covered with dark brown hair, and the neck is encircled by a white band.

THE PORCUPINE.

The porcupine leads a dreary, solitary life; during the day it hides away in its burrow, from which it emerges at night to look for food. This consists of herbs, roots, and fruit. The porcupine needs very little water, all that is necessary being supplied by succulent fruits.

It does not undergo regular hibernation, although it only emerges at great intervals from its burrow during the winter. When attacked, the porcupine raises the spines, rattles with the tail, and then turns its back to the enemy to advance, or rather retreat, against him, in order to bury the spines in his flesh. Once embedded in the latter, they are difficult to remove, and, when allowed to remain any length of time, they cause suppuration, which has in some cases been followed by death. Although the animal could inflict serious wounds by biting, it never uses its teeth defensively; this is probably due to an instinctive desire to protect the nose. The latter is very sensitive; a blow even with a cane is sufficient to stun or even kill the animal; when pressed to the last, it therefore sticks its head under the belly and rolls up into a ball.

The porcupine is hunted extensively in the southern parts of Europe and in Africa on account of the spines, which are of some commercial value. The meat is also esteemed by many. It is hunted at night by dogs. When brought to a stand it is either caught alive by means of a large cloth thrown around it, or the hunter, allowing it to approach him, keeps it off with a stick, steps back, and immediately inflicts the deadly blow on the nose.

In imprisonment it is easily tamed, and, when caught young, it learns to know its master and follows him like a dog. It never loses its timidity, however, and the least unusual noise or strange object throws it into fits of fright and anguish.

Summer Flowers in Winter.

Roses are popular at all seasons. At midwinter no rose is held in higher esteem in New York than the Jacqueminot, or "Jack" rose, as it is commonly called. The "Jack" is only an ordinary June rose such as may be seen in any roadside garden on a summer's day. The secret of its popularity lies in its rarity and in the difficulty of bringing it to perfection at midwinter. To do this it is necessary to dig up the plants after they have done flowering in the summer, freeze them in an ice house, allow them to remain frozen for a while and then restore them to life and force them to maturity with a high degree of heat.

Next to the roses the favorite flowers for this season are the lilies of the valley, a few sprays of which will pervade a whole room with their sweet subtle fragrance. They are very rare, and sell at New Year's for 20 and 25 cents a single spray. That they are so costly is in a large measure owing to the fact that to be produced in full perfection at this season they, too, must be taken up and frozen after flowering in the summer, and afterward forced to a second maturity in the same year by great heat. By this freezing process the entire rotation of seasons is reproduced within a few months.

Physiology of the Brain.

Dr. Brown Séquard, formerly of this city, has removed to Paris, and about the first of December he began his course of lectures on physiology at the Collége de France. In his opening address, according to the *Lancet*, he made known the subject which it was his intention to treat of this year. He proposed to combat all the doctrines which are actually received upon the physiology of the brain, and especially those which have reference to cerebral localization. He will study the mode of action of the brain upon the spinal cord, and will discuss the question whether it is right to admit the existence of two brains or one only. He will then review all the lesions of the brain which are capable of producing physiological or morbid phenomena. According to Dr. Brown Séquard, each half of the brain possesses all the functions of the encephalon; it is capable of any act, and can perceive all sensations. He hopes to be able to show that it is not indispensable to admit the theory of the decussation of the nervous fibers of the right side to the left and *vice versa*, and that each half of the brain is capable of perceiving all sensations emanating from any point of the body.

Dr. Brown Séquard believes in the existence of cerebral localizations, but maintains that the localizations, instead of existing in certain limited points of the brain substance, are composed of elements disseminated everywhere. He then cited a certain number of facts which would tend to show that the center of speech is not situated, as Broca has stated, on the posterior part of the third frontal convolution of the left side. The eminent professor has already exposed his views upon this subject in an interesting discussion which took place before the Société de Biologie in 1876. It is not his intention to have recourse to experimentation to demonstrate the truth of his doctrines, but will bring forward pathological facts in support of them.

Trichinæ.

Some investigations have just been completed by two Chicago microscopists as to the prevalence of trichinæ in the pork that comes to our markets, that seem worthy of record. Some time ago Dr. William T. Belfield, Demonstrator of Physiology in Rush Medical College, and Mr. H. T. Atwood, Vice President of the State Microscopical Society of Illinois, were asked by the Commissioner of Health, of Chicago, Dr. DeWolf, to examine specimens of pork taken at random from the hogs being slaughtered at the different slaughtering houses. Specimens from one hundred hogs were carefully examined, and in eight trichinæ were found, the number varying according to estimate from thirty-five to thirteen thousand to the cubic inch of muscle. This s doubtless approximately the average of infection of the pork brought to Chicago for packing. The trichinous disease among hogs—if disease it is—must be much more prevalent now than ten or twelve years ago. Then an examination of quite a large number of hogs in behalf of the Academy of Sciences showed only about one in fifty infected.

Messrs. Belfield and Atwood have experimented with rats and other animals, to which they have fed trichinæ, and have reached the conclusion that, taken in small numbers and not too frequently, any animal or man may eat these worms with impunity. A rat weighing two ounces was fed at intervals of two or three days a few trichinæ for six weeks, when it was killed. It was full of live trichinæ—which, immersed in warm water, would move vigorously—the estimated number in the rat being 100,000. During the six weeks the rat appeared perfectly healthy. Dr. Belfield felt so sure of the innocuousness of small numbers of the worms, that he made a practical test by himself eating twelve live trichinæ three weeks ago. He has not experienced an unpleasant symptom to date. He believes a large per cent of our population are really infected with trichinæ. It is a fact in confirmation of the theory of these observers, that many of the infected hogs have received the trichinæ without symptoms of disease, certainly without any damage to their fattening qualities. It is surely impossible that eight per cent of all the hogs raised for market could get sick with symptoms approaching in severity those of severe human infection, without such a panic among farmers as would be noticed by the whole country.

Some experiments with different agents used for the destruction of the worms showed that the best inexpensive agent was sulphurous acid; a very little of this acid, mixed with the brine in which pork is preserved or pickled, will kill all the trichinæ, without, of course, any damage to the pork for any purpose. The lowest per cent of the acid required to be effectual has not yet been determined.—*Medical Record.*

Recent Work at the U. S. Torpedo Station, Newport.

Premising that comparatively little has been done at Newport for the improvement of torpedoes during the past two years, owing to the smallness of the appropriations therefor, a special correspondent of the *World* writes that one of the most important discoveries made within that time has been Lieutenant A. R. Couden's improved method of determining the internal resistance of galvanic batteries. The method hitherto practiced at the station is described by Professor Farmer as follows:

"Introduce into the circuit of a galvanic battery a convenient rheostat and a suitable fine wire galvanometer. Open and adjust the rheostat until a convenient deflection is obtained (42° 21′ is liable to least error); note carefully the deflection. Next reduce the total external resistance of the circuit one half. (This presupposes that the rheostat, as opened, offers more resistance than the galvanometer.) The needle will now be deflected more than it was at the first observation. If now another adjustable rheostat be used as a

shunt across the terminals of the battery, this shunt can be so adjusted that the reading of the galvanometer shall return to the same position as in the first observation. When this is the case, the resistance of the shunt is equal to the internal resistance of the battery."

Lieutenant Couden conceived the idea that if the two changes, viz., shortening the resistance and applying the shunt, were made simultaneously, there would be at the first instant no movement of the needle, if the proper shunt were first chosen. He availed himself of the two keys used in manipulating the Wheatstone bridge to carry out the idea. The results were quite satisfactory, but the two keys being independent of each other and far apart required two fingers to press them, and sometimes failed to operate with complete simultaneity. To remedy this Professor Farmer had made for Lieutenant Couden a key with a single finger piece, but with two independent contact closers, which admitted of such adjustment as to secure the required simultaneous closing of the two circuits when the key was depressed. The apparatus as thus constructed operates with entire satisfaction.

Improvements have also been made in the method of splicing the torpedo cables and leading-wires now issued to ships. Mr. Farmer says that in all insulated wire now issued to ships for permanent wires, for spar leading-wires, and torpedo cables, the conductor consists of seven strands of small copper wire, and is therefore very flexible. Should it become necessary to join two pieces of cable together, it can now be done by knotting the wire by, first, a sheet bend; second, a reef knot; third, a carrick bend. The advantages over the earlier form of splicing are fourfold, viz., first, the splicing nippers and splicers in the supply box are abolished; second, instruction to the sailor is unnecessary, and the operation is more quickly performed; third, it is the strongest way of joining two pieces of wire; fourth, the electrical properties are all that can be desired.

The modification and improvements in the electric primer are as follows: In putting in the bridge great uniformity in length and consequently in the electrical resistance is obtained; rounding up the quills so that the primers will enter the vent guns freely; a method of "choking in" the quills and securing them firmly to the wires.

The United States steamer Trenton's electrical apparatus is a noteworthy result of discoveries at the torpedo station. A full description of it would occupy too much space, but it may be stated that it is for two distinct purposes—firing of guns and torpedoes, and calls and automatic fire alarms. That intended for guns and torpedoes is designed to place the firing under the control of a single officer stationed at some central point, who shall be able to fire any gun when it is ready, or either or both broadsides, or as much of a broadside as may be ready.

Professor Walter N. Hill has made a variety of experiments in chemistry, as pertaining to torpedo construction and firing, and below are given a few opinions he gives as a result of them. He states that liquid nitro-glycerine is readily exploded, as is well known to scientists, by five to ten grains of fulminating mercury, but when frozen he has never been able to fire it. When dynamite freezes to a loose, fine powder, he finds it may be exploded with tolerable certainty by the ordinary detonating fuse (fifteen to twenty grains of fulminate). In a large number of experiments with small amounts he found but very few cases when explosion did not occur. But in proportion as it is solidly frozen, that is compacted together, the explosion is less sure. It would be uninteresting to give particulars in detail of the experiments. It is sufficient to state that the conclusions arrived at are that an exploder containing fulminating mercury only will not fire frozen dynamite with any degree of certainty. In the experiments it did so twice, but in one instance it is doubtful if the charge was well frozen.

The present service torpedo has proved objectionable for several reasons, principally on account of its weight, lack of strength, and the great surface offered for resistance in being towed through the water, whether ahead or abeam. A new design has been perfected; it is of steel, and possesses decided advantages over the present service pattern, being stronger, lighter, and offering less surface for resistance. The cost of each steel torpedo is about $60, and as even ten would be a very small number to experiment with it has been found impossible to make much progress. Their general shape is very nearly that of a sphere. Another feature they possess, an advantage over the service pattern, is the mode of attaching them to a spar or outrigger; the center of the torpedo case lies in a prolongation of the axis of the spar, and is secured to it by a conical cap permanently attached to the torpedo case, and also of steel, which is keyed to a metal cone rigidly secured to the end of the spar; this mode of attachment reduces the surface of the spar exposed to the effect of explosion, and the force is exerted in the direction of the length of the spar, the most advantageous for the spar and the boat. Further trials have been had with the improved spar, fitted with the attachments of spars to the forward guy and topping lift, and it continues to give good results, tows well, preserves its immersion, vibrates but little, and has stood the fire of twelve service 100-pounder torpedoes without any material injury. It has been found that, in the case of boat spars, if the spar is left free to recoil, the effect upon the boat and spar is reduced; the spar recoils usually from 10 to 15 feet, but not past the balancing point, therefore not coming into the boat. A ready man at the heel rope can easily, at this time, rig the spar in by a pull on the heel rope, leaving the launch free to steam without the drag of the spar. Spars have been very successfully worked in this way at the station, and a number of spars have each withstood the explosions of six service boat torpedoes without any considerable damage. By this precaution the lifetime of the spar is prolonged.

A towing torpedo, capable of being towed on either quarter or shifted from one quarter to the other while being towed, has been designed, and the trials had with a little working model give promise of success with a larger and more practicable one.

Experiments have also been made with the fittings designed for fast torpedo launches, with a view to determine the requisite strength for a beam spar. The results have been satisfactory.

A small non-automatic hand lamp, constructed by Mr. Farmer, for use on the torpedo boat Lightning, has proved very advantageous as a means of signaling when its beams have been waved in the sky in a manner somewhat similar to the usual method of waving a signal flag. In dark and cloudy nights this method of signaling has some advantages, since the position of the lamp can be screened, as, for instance, by being sunk in a rifle pit, so that its exact location could not be determined at a distance.

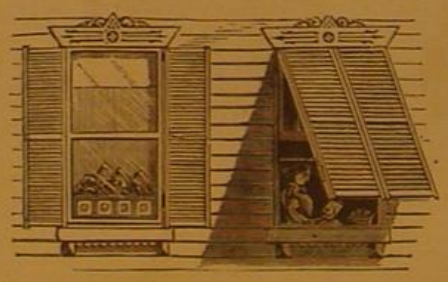
Some experiments have been tried with parallel carbons arranged somewhat after the plan of the carbons in the electric candle of M. Jablochkoff, but a sufficient number have not yet been tried to warrant an expression of opinion as to the serviceableness of carbons used in that manner.

Experiments have also been made with the telephone in order to ascertain its suitableness for communication between the bridge and the powder magazine, as well as between other parts of the ship. It has been found possible to communicate over a circuit of 22,000 ohms, having a stated capacity of eight microfarads, whence it is easy to see that it would be entirely feasible to communicate through an ocean cable between two stations that should be at least 500 miles apart. The rapidity of communication, too, is astonishing, since 145 words in 17 seconds were distinctly heard over a short circuit. This is at the rate of 512 words per minute. The possibility of communicating with way stations at a distance from the direct line, and without a loop, has been satisfactorily demonstrated by Professor Farmer and his assistants.

Captain F. M. Ramsey, United States Navy, is now in charge of the station, having succeeded Captain K. R. Breeze, who is now preparing a *résumé* of all the work that has been done at the torpedo station.

IMPROVED WINDOW AWNING.

With the ordinary wooden blinds placed on the exterior of windows it is only possible to open and close them one way. The annexed illustration represents an improved form



WINDOW AWNING.

of blind, window screen, or awning applicable to all windows in brick and wooden buildings where ordinary blinds are in use, and also to bay windows where there is little or no chance to swing blinds back. The improvement consists in constructing the blind so that it will swing on hinges as usual, and in addition to this the two halves can be drawn and fastened together to form one entire blind, and then quickly and easily adjusted to swing from a top horizontal hinge, instead of the vertical ones.

The blind can be used both ways, as shown in the cut, and the improvement may be applied to either old or new blinds; it is an economical and effective way of shading a window; it makes a perfect screen from outside observation; and it allows a free circulation of air. The view from the inside is not obstructed; blind fasteners are dispensed with, a bolt being used to hold the blinds together, and arms are provided which hold them open against the house. This kind of blind can be used in fall or winter, when a cloth awning has to be taken down to preserve it. Further information may be had from the Boston Blower Co., 2 Foster's Wharf, Atlantic avenue, Boston, Mass.

Carbolate of Soda for Whooping Cough.

Dr. Pernot describes in the *Lyons Medical Record* a very successful treatment of whooping cough with carbolate of soda. He places the carbolate of soda in a small porcelain crucible held above the flame of a spirit lamp, which keeps it in an unvarying temperature as long as wished. As the carbolate of soda becomes volatilized, the atmosphere of the sick room is impregnated with the vapor of carbolic acid.

When the crucible and lamp are not at hand, a satisfactory substitute is found in a fire brick heated enough to vaporize the carbolate. In numerous cases the following results have been obtained:

1. A notable diminution of the paroxysms of coughing after from two to ten days' treatment. 2. Less labored and painful respiration. 3. Shorter duration of the paroxysms of coughing. 4. The most confirmed attack of whooping cough remains *in statu quo* from the commencement of the treatment, and it always appeared to him to diminish more or less rapidly, but always in a time relatively short to its usual duration.

The vapors of carbolate of soda have valuable disinfecting and antiseptic properties.

It is worthy of note in this connection that the fungoid origin of whooping cough, asserted some years since by M. Svetzerich, seems to be confirmed by the recent researches of M. Yschamer, who says he has found certain lower organisms in the spittle of whooping cough patients—organisms not met with in any other disease accompanied by cough and expectoration. He claims, further, that the organisms in question are identical with those which, by their agglomeration, form the black points on the skins of oranges and the parings of certain fruits, especially apples. Thus, M. Yschamer, by inoculating rabbits with this dark matter, or even causing it to be inhaled by men, produced fits of coughing several days in duration, and presenting all the characters of the convulsive whooping cough.

How Roquefort Cheese is Made.

In an address on "Dairy Interests Abroad," at the International Dairy Fair, Mr. F. B. Thurber gave the following account of the manufacture of this variety of cheese:

The French Roquefort is made from the milk of sheep and goats, principally from that of the former. In 1866 250,000 out of a flock of 400,000 supplied the milk for 7,150,000 lbs. of cheese. The fertile pasturage of these animals is an immense plain, 8 or 10 leagues across. In the evening, after the return of the sheep from the pastures, they are allowed to rest for an hour before being milked, after which they will yield the milk more readily, and are milked as rapidly as possible. From May 1 to the middle of July the yield of milk is the largest, and each animal gives nearly a pint.

The Larzac breed of sheep, from the milk of which the cheese is made, have large udders, made so by beating them with the hand as soon as the milk ceases to flow. The evening's milk is heated almost to boiling and set aside. In the morning it is skimmed, heated to 98°, and mixed with the morning's milk for coagulation. After the curd has been divided by stirring with a paddle and the whey drawn off, it is kneaded with the hands and pressed in layers into moulds with perforated bottoms, and usually a thin layer of mouldy bread made of summer and winter barley, sour dough and vinegar, is put between the layers of curd to hasten the ripening of the cheese by supplying the germs of the green mould peculiar to cheese. The curd remains under pressure for three or four days, after which the cheeses are wrapped in linen and put to dry. After drying for three or four days they are taken to the village of Roquefort, where the ripening is completed in a peculiar manner.

The village is situated in a deep, narrow gorge, with high precipitous walls of limestone rock overhanging. These walls are full of caves and fissures, from which currents of cold air issue at a temperature, in the hottest weather, of from 41° to 44°. The air currents flow from south to north, and are believed to yield the best cheese. The proprietors of the vaults purchase cheeses at all seasons from the shepherds. They are carefully examined and classified. Salt is then sprinkled over them, and they are piled up for two or three days; then the piles are taken down, the salt and brine rubbed in, and they are piled up again. After a week in the vaults, they are scraped and pared, pricked through with needles, driven by machinery, to accelerate the moulding, and again kept in piles for fifteen days, or until they become dry and firm in texture, and become covered with a white mould, with filaments sometimes five or six inches long. Its succulency and thickness indicate the quality of the cheese.

New Agricultural Inventions.

Mr. Slaughter G. Major, of Haynesville, Mo., has patented an improved device for use in Milking Cows, which is convenient and may be easily and quickly applied, and will not injure the cow.

Mr. William J. Klaunig, of Richmond, Va., has patented an improved Mower, having a wave wheel of peculiar form which imparts to the knives a scythe-like cutting action, that prevents the dropping of the grain from the ears, which is likely to occur in the ordinary machine from the rapidly reciprocating motion of the knives, which motion shakes out the grain, and compels, therefore, the cutting of the grain before it has become entirely ripe.

PARAFFINE AS A LUBRICANT.—A correspondent of the *Railroad Gazette* announces that the Erie railway has reduced its oiling expenses from $5,000 to $1,000 a year by using paraffine on passenger car journals, and has reduced the number of hot journals from 535 to 332. It is now used during the winter months, without the addition of any other oil, but it is found that in summer it becomes so limpid that it is hard to keep it in the axle boxes. During the summer months it is therefore mixed with some other lubricant to give it more "body."

ERRATUM.—In our issue of January 18, p. 35, in the article on the Columbia bicycle, the description should read: "The front wheel bearings are conical and well hardened, and fitted with coned fastenings. The India-rubber is 1 inch on the front and ¾ inch diameter on the back wheel."

Accuracy a Path to Wealth.

In this age of guesswork it is refreshing to read an article on the following, contributed to the *Methodist* by John D. Knox, of Topeka, Kansas, on the importance of exactness. The author commences with the importance of accuracy in the value of testimony, all depending on its exactness, and proceeds to say: The professed end of logic is to teach men to think, to judge and reason with precision and accuracy. S. Martin asks: "What makes the scholar? Exactness. What is most likely to secure success in the learned professions? Exactness. What raises men of various callings to the highest position attainable by persons in their occupations? Exactness. What makes a man's word pass current as gold? His known exactness. What, above all things, is essential in the laboratory? Exactness."

Mr. Martin is right. Exactness, accuracy, perfection in all the work you undertake will bring you a sure reward. And the record of a noted man is found in these words: "He became an honorable man, successful merchant, and bank president." His splendid career commenced in blacking a pair of boots well when a boy; and he continued "doing well" all through life, whether blacking boots or managing finance. What he did he did accurately, and, of course, it did not have to be done over or improved or mended, but always gave satisfaction and secured commendation.

President Tuttle, on "How to Get the Best Place," gives us this instance: "I saw a young man in the office of a Western railway superintendent. He was occupying a position that four hundred boys in the city would have wished to get. It was honorable and 'it paid well,' besides being in the line of promotion. How did he get it? Not by having a rich father, for he was the son of a laborer. The secret was, his beautiful accuracy. He began as an errand boy, and did his work accurately. His leisure time he used in perfecting his writing and arithmetic. After a while he learned to telegraph. At each step his employer commended his accuracy, and relied on what he did because he was sure it was just right.'

And it is thus with every occupation. The accurate boy is the favored one. Those who employ men do not wish to be on the constant lookout, as though they were rogues or fools. If a carpenter must stand at his journeyman's elbow to be sure his work is right, or if a cashier must run over his book-keeper's columns, he might as well do the work himself as to employ another one to do it in that way; and it is very certain that the employer will get rid of such an inaccurate workman as soon as possible.

I knew such a young man. He had a good chance to do well, but he was so inaccurate and unreliable that people were afraid to trust him. If he wrote a deed or mortgage or a contract, he was sure to leave out something or put in something to make it an imperfect paper. He was a lawyer without business, because he lacked the noble quality of accuracy.

Just across the street from him was another young lawyer, who was proverbial for accuracy. He was famous for searching titles, and when he wrote out the history of a title to a piece of property, it was taken for granted as just so. His aim was absolute accuracy in every thing. If he copied a conveyance or cited a legal authority or made a statement, he aimed to do it exactly. The consequence is, he is having a valuable practice at the bar and is universally esteemed.

"But," says some boy, "when I become a man that is the way I shall do. I mean to be very accurate." Perhaps so; I could tell better if I knew just how you do your work now. There are several ways of getting a lesson. One is to get it "tolerably well," which does not cost much labor; the other is to get it faultlessly well, which costs a great deal of labor. A boy can get a general idea of his lesson "in a jiffy;" but to get it accurately is very hard, and requires both time and industry. If you, my boy, to-day are getting your lesson in the slipshod way, you will grow up a slipshod man; but if to-day your habit is to get every lesson with perfect accuracy, I will warrant you will do that way when you become a man. How is it?

Millions of persons in the world are clamoring for work, and work is abundant; but they are careless, inaccurate, unreliable, untrustworthy. Shake off your stupidity, idle one; get wide awake and do your work well. Accurate, perfect, for even a dot or point may shelter you or turn you out of doors.

To illustrate the importance of accuracy and careful, honest work, take this instance of loss by bad penmanship: "A decision was rendered by Judge Van Brunt, of New York, which may be of interest to those who are careless in preparing manuscript, and think anything in the guise of handwriting will do that can either be deciphered or guessed at. It was a suit brought to recover damages from a telegraph company for errors committed in transmitting a message, by which the party suing suffered pecuniary loss. On the trial the original message, as written and handed to the operator, was offered in evidence, and was so illegibly written that no two persons could agree from the marks submitted what it actually did contain. Whereupon the judge instructed the jury that if people wrote their dispatches in such a hand that the contents are uncertain, they have no right to recover damages from the dispatcher because he failed to read it correctly, and that if damages do result from such causes, the sender and not the company should bear the loss. This was good common sense, which is the essence of common law."

Some persons take no care at all in anything they do, forgetting that the interests of others, as well as themselves, depend upon the character of their work. It is not only a matter of cents and dollars, but it is a matter of morals.

DESIGNS FOR VASES.

The engraving on this page shows three elegant designs for vases in metal or ceramics. These designs are from the firm of Villeroy, of Mettlach.

Astronomical Notes.

OBSERVATORY OF VASSAR COLLEGE.

The computations in the following notes are by students of Vassar College. Although only approximate, they will enable the ordinary observer to find the planets.

M. M.

Positions of Planets for February, 1879.

Mercury.

February 1, Mercury rises at 6h. 18m. A.M., and sets at 3h. 25m. P.M. February 28, Mercury rises at 6h. 43m. A.M., and sets at 5h. 24m. P.M.

Mercury is far south in declination, and if seen at all, it will be during the first few days of February, some degrees south of the point of sunrise.

Venus.

February 1, Venus rises at 8h. 2m. A.M., and sets at 6h. 18m. P.M. February 28, Venus rises at 7h. 33m. A.M., and sets at 7h. 26m. P.M.

Venus will be seen after sunset, and will set farther and farther north of the point of sunset, through the month. February 22, the moon and Venus will be in conjunction.

DESIGNS FOR VASES IN METAL OR CERAMIC.

Mars.

February 1, Mars rises at 4h. 35m. A.M., and sets at 1h. 31m. P.M. February 28, Mars rises at 4h. 10m. A.M., and sets at 1h. 11m. P.M.

Mars will be seen only in the early morning, it is far south in declination, among the small stars of Sagittarius

Jupiter.

Jupiter sets in the early part of the month soon after the sun, and in the latter part before the sun; it will probably not be observed at all.

Saturn.

Although we are more distant from Saturn than in January, the planet can be seen in the February evenings. February 1 Saturn sets at 9h. 7m. P.M., and on the 28th, at 7h. 36m. P.M. The planet passes the meridian in daylight, and the smaller moons are more and more difficult to be seen. The ring of Saturn is so tipped relatively to the earth, as to be seen nearly edgewise, and to extend as a line across and beyond the planet's disk. On the evening of January 10, Titan was seen (in the large telescope of Vassar College) on the west of Saturn. Rhea, which is much smaller than Titan, and shines with a bluish light, on the east, while Dione and Enceladus could just be seen as tiny points of light above and below the extreme eastern point of the ring January 13, four of the small moons clustered in a group about the western extension of the ring, while Titan and Enceladus were on the east.

Saturn can be found, February 23, by its nearness to the crescent moon.

Uranus.

Uranus is the only planet which is well situated for observation in February. It is sometimes seen with the eye, and a small telescope will show a disk, and thereby enable one to distinguish it from a star. Uranus rises on February 1 at 6h. 56m. P.M., and sets at 8h. 16m. A.M. of the next day. On February 28, Uranus rises at 5 P.M., and sets at 6h. 24m. A.M. of the next day.

Uranus will be in conjunction with the moon (according to the American Ephemeris) at 11h. 40m., Washington time, on February 7; the planet will be a few degrees above the moon.

Uranus can also be found by its nearness to the star Rho Leonis.

Neptune.

Neptune cannot be seen except by very powerful telescopes. It sets February 1 a little after midnight, and on February 28 as early as 10h. 35m. P.M.

Care of the Eyes.

From the great demand for the eight numbers of the SUPPLEMENT to the SCIENTIFIC AMERICAN, in which appeared a series of articles on the preservation of the eyesight, it is evidently a subject in which most persons are more than ordinarily interested. As a writer on the care of the eyes, in an English paper, recently said: "All are anxious to do this, but few know how effectually to do so, and many never think of the matter till failing eyesight warns them that it is absolutely necessary. By the latter," says the same writer, "the following suggestions will be read with interest:

"The sight in most persons begins to fail from forty to fifty years of age, as is evidenced by an instinctive preference for large print; a seat near the window for reading is selected; there is an effort to place the paper at a convenient distance from the eye, or to turn it so as to get a particular reflection of the light; next the finger begins to be placed under the line read, and there is a winking of the eye as if to clear it, or a looking away at some distant object to rest it; or the fingers are pressed over the closed lids in the direction of the nose, to remove the tears caused by straining.

"Favor the failing sight as much as possible. Looking into a bright fire, especially a coal fire, is very injurious to the eyes. Looking at molten iron will soon destroy the sight; reading in the twilight is injurious to the eyes, as they are obliged to make great exertion. Reading or sewing with a side light injures the eyes, as both eyes should be exposed to an equal degree of light. The reason is, the sympathy between the eyes is so great that if the pupil of one is dilated by being kept partially in the shade, the one that is most exposed cannot contract itself sufficiently for protection, and will ultimately be injured. Those who wish to preserve their sight should observe the following rules, and preserve their general health by correct habit:

"1st. By sitting in such a position as will allow the light to fall obliquely over the shoulder upon the page or sewing.

"2d. By not using the eyes for such purposes by any artificial light.

"3d. By avoiding the special use of the eyes in the morning before breakfast.

"4th. By resting them for a half minute or so while reading or sewing or looking at small objects; and by looking at things at a distance, or up to the sky; relief is immediately felt by so doing.

"5th. Never pick any collected matter from the eyelashes or corners of the eyes with the finger-nails; rather moisten it with the saliva and rub it away with the ball of the finger.

"6th. Frequently pass the ball of the finger over the closed eyelids toward the nose; this carries off an excess of water into the nose itself by means of the little canal which leads into the nostril from each inner corner of the eye, this canal having a tendency to close up in consequence of the slight inflammation which attends weakness of eyes.

"7th. Keep the feet always dry and warm, so as to draw any excess of blood from the other end of the body.

8th. Use eyeglasses at first carried in the vest pocket attached to a guard, for they are instantly adjusted to the eye with very little trouble, whereas, if common spectacles are used such a process is required to get them ready that to save trouble the eyes are often strained to answer a purpose.

"9th. Wash the eyes abundantly every morning. If cold water is used let it be flapped against the closed eyes with the fingers, not striking hard against the balls of the eyes.

"10th. The moment the eyes feel tired, the very moment you are conscious of an effort to read or sew, lay aside the book or needle, and take a walk for an hour, or employ yourself in some active exercise not requiring the close use of the eyes."*

*The following are the numbers of the SUPPLEMENT containing the series of articles on preserving the eyesight: 135, 137, 139, 136, 139, 142, 144, 147. They will be mailed from this office on receipt of 80 cents.

Notes on Electrical Lighting.

The latest electric lamp in the field is that of Mr. J. B. Fuller, who claims that it has been in practical use for a year or more. The first public exhibition of the lamp was made a short time since at the office of the New York Electric Light Company, in Mercer street. Its power was said to be equal to 2,400 candles; the electricity being furnished by a generator patented by Mr. Fuller. This lamp uses carbon points. Mr. Fuller claims to have invented also a platinum lamp of 20 candle power which solves the problem of domestic lighting.

The carbon lamp, Mr. Fuller says, has been in use a year in the factory where his apparatus is made in Brooklyn. The cost of the generator and lamp was $290, and they are both as good to-day as when they were first used. The power used was so little that no charge was made for it by the parties furnishing the steam power for the shop. The carbon points cost 4 cents per hour. The shop lighted is 100 by 40 feet, and the light furnished is much better than gaslight. Roughly estimated, the first year's saving on the gas that would be required in the shop is more than enough to pay for the entire apparatus for producing the electric light. Of course that saving would not be effected where an engine and boiler would be required for the sole purpose of furnishing the motive power to the electric generator.

Mr. J. M. Stearnes, Jr., of Brooklyn, points out a novel source of danger possible with the electric light, namely, its effect upon the nervous system. He says:

"The very high penetrating power of light waves from incandescent metal or carbon heated by electricity is well known. It is so high, indeed, that the shadows cast by the light are blacker than Erebus, indicating an immense absorption of force by the intervening objects, and to a large extent destroying their reflection and diffusion, as is the case with lights of lesser tension. A reflector used with an electric or calcium light does not produce anything like a corresponding effect as when used with a common gas flame, as persons familiar with calcium lights well know. And it follows, therefore, that the black shadows of the electric flame must be due to the absorption of light waves. Now in the light of an electric arc or incandescent lamp, one is to be subjected to a very powerful stimulant from the mere obstruction which his body affords. Our eyes cannot bear it at all, and there is no reason to doubt that every nervous tissue will feel its use. We have already in this climate enough of nervous stimulation, and a fearful catalogue of nervous diseases, arising from too much force."

Mr. Stockley, the engineer of the Brush Company, does not claim that more than 18 of that kind of lights have been maintained in one circuit with one machine, the lights being each equal to 2,000 candles. How many could be maintained with more machines is not yet known. Perhaps no more. Sawyer & Man, who have the continuous carbon, claim that they have burned 17 lamps with the power of 5 gas burners each with one machine, but say they can maintain 50. Edison claimed originally that he could maintain some such absurd number as 10,000 with a 500 horse power engine, but now claims only to be able to keep 480 lights going with an 80 horse power engine. But none of the inventors have made any extended experiments whatever. Their claims are all guess work.

Professor Morton recently exhibited in Hoboken the Sugg gas burner from London, a burner which gives a very perfect combustion of gas. A 50 foot gas burner is found to give a light equal to that of 300 candles. The burner has been tried by many of the engineers of the gas companies of the city here, and they find that a 40 foot burner gives a light equal to that of 250 candles, and a 50 foot burner one equal to that of 300 candles. If, now, this same stream of gas be supplied to ten 5 foot Sugg burners, each light would be found to be equal only to 15 candles, the total not exceeding 150 candles, as against 300. If the gas was supplied to 50 burners, little half blue flames would be created, which would hardly be lights at all. The explanation is, that in the large lights the particles of carbon are simply in a state of more intense incandescence by reason of the greater heat. The lower the heat, the less intense the incandescence, and the more feeble the light. This fact of the loss of light by the subdivision of a current of gas is now fully established It shows that the loss of light by subdivision in electricity is not at all a unique circumstance. Intensity is lost both in gas lights and electric lights, and for exactly the same reason.

M. Carrê, of Paris, finds it necessary to extend his establishment for the manufacture of carbons for the electric light. There are more than 6,500 feet of carbons per day turned out at his works at present.

Now that electric lighting successes have caused so many old devices to be dressed up as new inventions, the *Engineer* remarks that it is difficult to understand why some attempt has not been made to improve upon the idea of Allan, and to produce electrodes in the form of a screw. It quotes this reference to Allan's lamp from the *Mechanics' Magazine* of 1852: "The two electrodes are placed perpendicularly to one another, and in this relation are made to rotate by a simple clock-work movement. The result is that as the edge of the spiral is in the course of being destroyed by the action of the current, and the distance between the two thereby increased, it is always regaining the proper position by the rotation of the electrodes producing fresh points for action. In this manner a constant distance or relation is preserved, and hence a constant, steady light, the grand desideratum, the duration of which will depend only upon the length of the thread of the screw."

A. M. Bailey, of Paris, has invented an electric spark pen which possesses some points of interest. If a sheet of thin paper is attached to a plate of copper or zinc, it is stated that an engraving may be made with extraordinary facility by means of this pen. If one of the poles of a Ruhmkorff machine is attached to the plate and the other to the upper end of the pen, the current will run through, and in drawing the paper is perforated. When the drawing is finished, ink is laid on with an ordinary roller and the greasy fluid penetrates through the holes. The plate is then plunged in water, which detaches the paper, and it is ready for immersion in the acid. The advantage claimed for this method is that the artist does all parts of his work and has no more trouble than if he were working with an ordinary pencil. He can even work in a dark room without any other light than the glare from the induction spark.

Mr. W. H. Preece, electrician to the British Post Office, says that he has sought in vain, at Paris and elsewhere, for an electric light which should meet the following three conditions, namely: (1) That the light be absolutely steady; (2) that it be brilliant, giving a light of 1,000 candles, or more; (3) that it be durable. Of all the lights, the only one he had seen which came up to his standard of brilliancy was the Serrin; the only one which came up to his criterion of steadiness was the Werdermann; and the only one sufficiently durable was the Wallace, by which he meant one which would last all night, and nights in England sometimes lasted eighteen hours. But there were several which came pretty near these criteria.

The Papaw Tree, and its Digestive Juice.

The papaw or papaya (*Carica papaya*) is a small tree, a native of tropical America, and cultivated particularly on the wooded slopes of the Andes. It seldom attains a height of over twenty feet; and its trunk, one foot in diameter at the base, gradually tapers upward without branching, and bears at its summit a crown of long-petioled leaves deeply cut into seven irregularly gashed lobes. The male and female flowers are borne on separate trees, and hence the tree receives from the natives the name "papaya," or "mamai," according to such views as each individual may entertain as to the pre-eminence of the sex.

The ripe fruit of the papaw is a melon-shaped berry about ten inches long and half as wide, with a thick, fleshy rind of an orange yellow color, which is sometimes eaten raw with sugar and pepper, but oftener cooked with sugar and lemon juice. The most interesting and important property attributed to the fruit, however, is the power of its juice to rapidly render hard flesh tender; and what is more remarkable still, newly killed meat, merely suspended among the branches of the tree, or wrapped up in its leaves, becomes tender in a wonderfully short time; and this fact, according to Professor Orton, is taken advantage of by Brazilian butchers to make their very toughest meat saleable.

As far back as the year 1750, Griffith Hughes says of the juice of the papaw fruit, in his "History of Barbadoes:" "This juice is of so penetrating a nature that if the unripe peeled fruit be boiled with the toughest old salted meat, it quickly makes it soft and tender, and if pigs be fed with the fruit, especially unripe, the thin mucous matter which coats the inside of the intestines is attacked, and if the food be not changed, is completely destroyed."

According to Browne, meat becomes tender after being washed with water to which the juice of *Carica papaya* has been added, and if left in such water ten minutes, it will fall from the spit while roasting, or separate into shreds while boiling. According to Karsten, the use of the papaw juice when boiling meat is very general in Quito, but in Venezuela and Costa Rica the practice is unknown.

Some further experiments were made by Roy, who, by making an incision in a single fruit, obtained 28·39 c.c. of the milky juice, which, after evaporating to dryness and again diluting with water, had a powerful action upon flesh, albumen, and gluten, while starch remained unaltered by it. Very recently Herr Wittmack has investigated the subject, and an account of his researches and experiments formed the subject of a paper communicated to the Berlin Natural History Society at one of its late sessions. The author obtained, after several incisions of half or unripe fruit, 1·195 grain of a white milky juice of the consistency of cream; the odor and flavor of this recalled that of petroleum or of vulcanized rubber. A portion of the juice was dissolved in three times its weight of water, and this was placed with 10 grammes of quite fresh lean beef in one piece in distilled water, and boiled for five minutes. Below the boiling point the meat fell into several pieces, and at the close of the experiment it had separated into coarse shreds. In the control experiments, made without the papaw juice, the boiled meat was visibly harder. Hard boiled albumen, digested with a little juice at a temperature of 20° C., could, after twenty-four hours, be easily broken up with a glass rod. Fifty grammes of beef in one piece, enveloped in a leaf of the papaw during twenty-four hours, at a temperature of 15° C., after a short boiling became perfectly tender; a similar piece wrapped in papaw and heated in the same manner, remained quite hard. Some comparative experiments were also made with pepsin, and the following conclusions are arrived at by the author: (1) The milky juice of *Carica papaya* is (or contains) a ferment which has an extraordinary energetic action upon nitrogenous substances; (2) it differs from pepsin in being active without the addition of a free acid, and, further, it operates at a higher temperature (60° to 65° C.) and in a shorter time (five minutes at most); (3) the filtered juice differs chemically from pepsin in that it gives no precipitate on boiling, and further that it is precipitated by mercuric chloride, iodine, and all mineral acids; (4) it resembles pepsin in being precipitated by neutral acetate of lead, and not giving a precipitate with sulphate of copper and perchloride of iron. An analysis of the juice of the papaw made in former years by Vauquelin, showed it to contain *fibrine*—a substance which at one time was supposed to be confined to the animal kingdom, but was known to exist in several vegetables.

The Color of Human Hair.

In the current number of the *Journal of the Anthropological Institute* appears a paper by Mr. H. C. Sorby, describing some researches in which he has endeavored to isolate the pigments of the hair, and to subject them to chemical and spectroscopic scrutiny. Hitherto little has been really known respecting the causes of the difference in color, and the distinctive characters of the various capillary pigments. Mr. Sorby concludes that hair is a colorless, horny substance, tinted in different specimens by three, or possibly four, distinct pigmentary bodies. Ordinary solvents, such as water and alcohol, have no action on the pigments, since these are protected by the horny matter. Sulphuric acid, more or less dilute, appears to be the best medium for separating the coloring principles. By this means the author obtains from different kinds of human hair a reddish, a yellow, and a black pigment. It is possible that the red, which is an unstable body, may pass into the yellow by a process of oxidation. Very red hair is characterized by the presence of the red constituent, unmodified by other pigments; dark red hair contains also some of the black pigmentary matter; golden hair has less of the red and more of the yellow principle; in sandy-brown hair the black and red constituents are associated with a large proportion of yellow coloring matter; in dark brown hair the black pigment increases at the expense of the others; while in black hair this dark coloring material completely overpowers the associated pigments.

It is a notable fact that Mr. Sorby found in some very black hair of a negro just as large a proportion of red pigment as in a very red hair of European origin. We may, therefore, safely conclude that if this negro had failed to develop the black pigment his hair would have been, not white, but as bright red as that of any red-haired European.

Perverted Ingenuity.

The Boston *Journal of Chemistry* thinks there is a good deal of perverted ingenuity in the world besides that which is directly criminal or mischievous in its purpose. It is indirectly criminal because it is a waste of labor and skill, sometimes even of health and life, in doing a difficult but utterly useless thing merely to show that it can be done, or for the sake of the notoriety which the achievement is likely to gain. Every museum has specimens of this misapplied toil and ingenuity—miniature models, carvings, and the like, which are marvels of delicacy and elaboration, but of no real artistic merit and of no possible practical value. If a solitary prisoner in his cell beguiles the weary years of his confinement with such patient labor, for the lack of other employment or diversion, we pardon while we pity him. We may even forgive the ubiquitous old woman who displays at the country fair the quilt of fourteen thousand and odd pieces of patchwork, as fearful in design and coloring as it is complicated in structure; for it may never have occurred to the worthy dame, and no Christian friend may have reminded her, that the time and work spent upon it would have served to knit some hundreds of pairs of hose for the barefoot poor, and have counted more to her credit on a certain long-running ledger than the coveted "premium" or "honorable mention" at the village show. But when sensible and cultivated people deliberately combine in planning and carrying out some silly performance of this kind, they ought not to receive the eulogies of the public press or the honors of international exhibitions.

These criticisms have been suggested by the accounts in foreign journals of a book which we are told was put into the market at the close of the French Exhibition. Its claim to distinction is the fact that it is the smallest book in the world. It is a "128mo" edition of Dante's "Divina Commedia," printed at Padua last year; a volume of 500 pages, measuring 5 centimeters (a trifle less than 2 inches) high, and 3½ (less than 1½ inch) broad. Only a thousand copies have been printed, and the type has been destroyed. It can be read only with a powerful magnifying glass.

Verily a noble example of "the art preservative of all arts!" Blindness and ophthalmia for the workmen engaged upon it, and the result a volume which nobody can read without a microscope, and which nobody will care to buy except the insatiable book hunter or curiosity monger! Is not this a worthy tribute to the great Florentine poet in this nineteenth century? Could he with prophetic vision have anticipated it, would he not have dedicated a warm corner in his "Inferno" to the special accommodation of Signor Gnocchi and Cantù, or whoever else is responsible for this infinitesimal monument of perverted ingenuity?

A Costly Telescope.

M. Camille Flammarion, of Paris, has recently published a number of articles to prove that the moon is inhabited, and is now organizing a committee to collect the necessary funds to construct a refracting telescope of sufficient power to see them. He calculates the cost of the instrument at one million francs.

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Notes & Queries

(1) W. C. M., J. B. C., and E. F., who ask for books, should address the publishers who advertise in the SCIENTIFIC AMERICAN, for catalogues.

(2) H. R. R. has an engine of the following dimensions: 10 inches cylinder, 18 inches stroke, piston rod 2 inches, crank pin 2 inches, shaft 4½ inches diameter, 6 feet long, fly wheel weighs 800 lbs., rim 14 inches wide x ¾ thick; engine makes 130 revolutions per minute, and asks what sized fly wheel he may use instead of the present one. A. A wheel of three times the diameter and double the weight of the present one may be used.

(3) E. E. H. asks: 1. What kind of pump runs with the least power? A. Pumps made without packing generally give the highest efficiency. 2. Will two pumps of the same size pump enough water to fill a pipe of the size of one of the pump barrels? A. They can be made to do so.

(4) F. W.—For receipts for tempering mill picks, see p. 219 (27) vol. 29.

(5) P. A. D. asks: 1. Why is the outside rail on a curve on the railroad the highest? A. To counteract the centrifugal force of the train as it passes the curve. 2. Do the outside wheels of a railroad car slide any in going around a curve? A. Generally, the inside wheel slips.

(6) C. W. G. asks: Is it possible to obtain CO from $K_4FeC_6N_6+6H_2SO_4$ without adding the 6 parts H_2O? A. Yes, but the decomposition is not complete. The gas is usually prepared from the crystallized salt ($K_4FeCy_6+3H_2O$) with eight or ten times its weight of strong oil of vitriol. If the acid is diluted with water, hydrocyanic acid is given off with or instead of carbonous oxide, thus: $2K_4FeC_6N_6+6H_2SO_4+XH_2O=FeK_2FeCy_6+6HKSO_4+6HCy+XH_2O$.

(7) R. H. E. writes: I have read that 33·1 cubic feet of steam expended per minute was equal to an actual horse power. Is this so? A. The power of an engine cannot be estimated by the capacity of its cylinder, nor by the number of cubic feet of steam used in a given time. These are only factors of the calculation.

(8) "Subscriber" writes: A friend of mine says that when a river is rising it will either rise till 12 o'clock at noon or 12 o'clock at midnight. I claim that this is not true, excepting when there is a tide which would change at that time. A. We agree with you.

(9) F. H. asks: What causes hammering in steam pipes, the steam pressure being about the same at all times and the pipes are constantly fed with live steam? A. It is probably due to defective circulation.

(10) X. asks: What is gained by forcing cold feed water into the steam room of a boiler instead of pumping it into the water space in the usual way? A. There is no gain of efficiency, and, generally, no gain of any kind, although, in some special cases, the circulation might possibly be promoted by this method of feeding.

(11) W. A. P. writes: I have in my house two gas lights in different rooms, both 18 inches from the ceiling, one has a globe and the other has not; the one without the globe blacks or spots the plastering, the one with the globe does not; why is it? A. The globe probably insures more perfect combustion by directing a uniform current of air over the flame.

(12) E. W. asks for directions for making a Leyden jar. A. Take an ordinary candy jar one or two quart, according to size required, coat it inside and outside for about three fourths the distance from the bottom toward the top with thin tin foil. The jar is coated with thick shellac varnish, and the foil is immediately pressed on. The jar should have a wooden cover, through the center of which passes a rod having at its lower end a chain that touches the tin foil at the bottom of the jar, and at its upper end a brass knob.

(13) R. D. McN. asks what will bring out the color on parchment. I have some deeds that got wet, and have faded. A. Moisten the ink with a strong aqueous solution of tannic acid.

(14) R. P. S. asks: How will I obtain a finish or polish on wood lathe work, to imitate gutta-percha? A. A small quantity of good Japan black will probably give satisfaction. The wood should be dry, and if possible, warm.

(15) L. B. R.—For solution of the wagon wheel problem, see p. 394 of last vol. of SCIENTIFIC AMERICAN.

(16) J. C. G. writes: I am building a steamer 30 feet long, 6 feet beam; my engines are a double 3 x 4. Have I power enough to propel such a boat 8 miles an hour? Do I get the same effective force in fresh water as I would in salt? A. The engines are of sufficient size. In fresh water, the immersed section is a little greater than in salt water.

(17) J. E. W. says: 1. Can an ice yacht, vessel, or any other object, sail faster than the wind? A. A first class ice boat running on smooth ice, managed by an experienced captain, will travel sixty miles an hour, the velocity of the wind that drives the boat being only fifteen miles an hour. For explanation, with engraving of boat see SCIENTIFIC AMERICAN SUPPLEMENT No. 61. 2. If so, is not the cause greater than the effect, or is not the created greater than the creator? A. These queries are a little mixed. 3. The above questions were discussed before the Wilmington, N. C., Library Association, and were left for your decision in your journal. A. Your association should take the SCIENTIFIC AMERICAN, in which hundreds of interesting practical questions are presented, with information promotive of intelligent discussion.

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

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

Human Knowledge. By G. V.

On Telephones and Sounders. By J. E. N.

[OFFICIAL.

INDEX OF INVENTIONS

FOR WHICH

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

December 3, 1878,

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.

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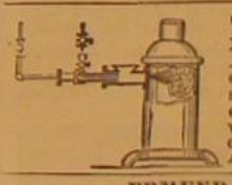

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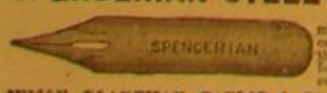

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AMERICAN INDUSTRIES.—No. 4.

BY HAMILTON S. WICKS.

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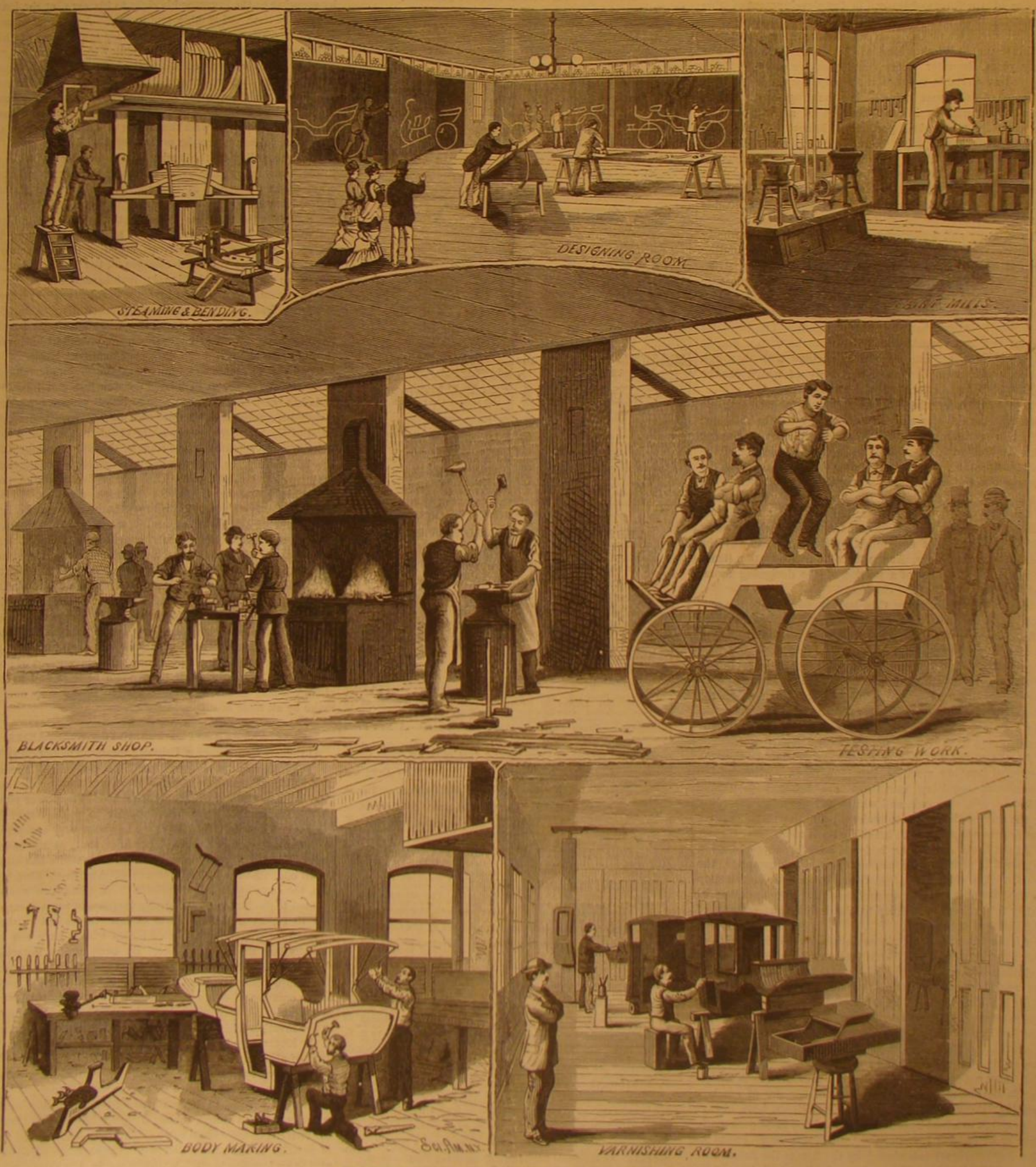
The business of carriage making is essentially a modern industry. The present century was well advanced before the number of people able to afford the luxury of a pleasure carriage became large enough to warrant the devotion of an entire establishment, much less a large establishment, to the production of these emblems and accompaniments of wealth and fashion. The unprecedented prosperity of the civilized world, particularly its American portion, during the past fifty years, however, has so rapidly multiplied the owners and users of carriages, that the business of meeting their wants has developed into an industry which ranks among the first in scope and magnitude.

Like many other industries carriage making in America has had a markedly characteristic development. An American-made carriage is recognizable as such wherever it may be found; and the features which distinguish it are those which give evidence of the highest taste and skill in construction.

The special features of American pleasure carriages, in comparison with those of Europe, are found in their fine lines, extreme lightness, and beauty of finish—peculiarities which, however paradoxical it seems to those whose judgment has been formed on foreign standards, are entirely consistent with superior strength and durability.

Several causes have united to determine this result. In the first place, American woods and irons have excelled the corresponding materials used abroad in strength, toughness, and other qualities requisite to give great endurance with little weight. As a natural consequence of working with such materials American artisans have learned to admire



BREWSTER & CO.'S CARRIAGE MANUFACTORY.

forms that combine delicacy with strength, and to abhor the loading of any structure with material that, performing no useful function, merely adds dead weight, an ultimate source of weakness. The bulkiness which the foreign artisan calls solidity, is to the American an eyesore, especially in machines or other structures which have to be moved, every pound of unneeded "solidity" merely adding to the cost of motive power. And it is not only in the choice of materials—the habit of selecting for each part of a complicated structure the material which will best do the required work—that American workmanship shows itself; but also in skillfully making the most of the materials which nature furnishes. The English wheelwright, for example, wishing a stick of peculiar shape in constructing a carriage, cuts the piece out of a block, and makes it heavy enough for the service required, letting bulk atone for the loss of tenacity incident to cutting across the grain. The American invents a method of steaming and bending a straight-grained stick to the shape desired.

The influence of conditions like these is radical; and American carriage building has, therefore, followed its own lines of development, not only in perfecting styles originating abroad, but in creating other styles specially adapted to the varying requirements of different parts of the country, and the preferences of individual minds untrammeled by fashion or undue deference to established forms and usages. As one of the foremost leaders in the development of this important industry the house of Brewster & Co., of Broome street, may fairly be selected as a representative in this series of illustrations of American industry. For sixty years, Brewster wagons and pleasure carriages have enjoyed an enviable reputation for superior merit; and the influence of this house in furthering the progress of American carriage industry in the directions of artistic taste in construction, mechanical perfection, honest material, and sterling workmanship, has been second to none. The exhibit of this firm at Paris, last summer, was conspicuous for its scope and excellence; and their award of gold medals in competition with the leading carriage makers of Europe is evidence that their high reputation at home and abroad is not undeserved.

The factory and warerooms of Brewster & Co., formerly on Broome street, are now situated on Broadway, extending from 47th to 48th street. In this building, a five story structure, 200 by 175 feet, is built every description of pleasure carriages, from the massive four horse drag introduced by Colonel Kane for fashionable coaching, to racing sulkies weighing no more than forty-three pounds. The Brewster wagon is a noted specialty. The firm make also a double suspension carriage hung on eight springs with thorough braces, and a new dog cart, the body of which can be shifted backward or forward without alighting.

To obtain a comprehensive idea of this establishment, one must take the elevator and ascend to the top of the building; thence in gradual descent visit each department, beginning with the body making, continuing with the painting of the bodies and running gear, and ending with the finishing department on the second floor, where the parts of the vehicle are put together and given the finishing touches. Each of these several departments is in charge of a master mechanic, who is permitted a share in the profits of the concern, and held to a strict accountability for the quality of the work under his charge. At the top of our illustration (front page) is given a view of a portion of the designing room, the real birth place of the carriage.

In an establishment like this, largely devoted to the production of carriages to order, stereotyped forms and styles will not always answer. New designs have to be invented to meet the demands of varying individual taste and new requirements arising from local condition and novel uses. These new forms are invented and elaborated in the designing room, where they are finally drawn full size on the blackboard. From the perfected and accepted designs working drawings are made, and the several parts are allotted for construction to skilled mechanics in each department.

At the upper left corner of the illustration is shown a powerful bending machine, in which those portions of the framework requiring curvature are brought to shape. Hickory, ash, elm, oak, and whitewood are used, according to the service the part is to undergo; and the machine gives the desired shape without breaking the grain.

At the lower corner the body of a leather-topped landau is shown in process of construction. When complete, the woodwork of the body is transferred to the blacksmith shop in the basement to be hung and ironed. Here the clang of thirty forges noisily testifies to the industrious activity of the entire establishment.

After ironing, the body is submitted to the inspection of the superintendent, and then taken to an upper floor for painting—an important part of the work, but one calling for no special description here. The testing of the finished carriage is the only scene that breaks the general gravity of the entire process. The first occupants of my lady's carriage are not fashionably dressed, nor are their movements entirely graceful, but the test is a necessary one, and the workmen are solid and nearest at hand for the purpose.

It must not be forgotten that, while they have been leaders in the development and perfecting of the art of carriage making, Brewster & Co., of Broome street, have always been quick to adopt improvements made by their own workmen or by outside inventors. One of the more recent of the improvements introduced by the firm is the patent rubber cushioned axle, which reduces jolting, and largely increases the safety and durability of the carriage.

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KEEP TO THE POINT.

In very much of the talk in Congress and out of it about the proposed amendment of the patent law, there is a tendency on one side to neglect, on the other to adroitly conceal, one vital feature of the entire patent system, namely, that a patent is not a grant of privilege, but a contract on the part of the government to secure to the inventor for a prescribed period a right which exists by virtue of the inventor's creative act.

The sole object of the patent system, as announced in the Constitution, is to promote the progress of science and the useful arts; the only method by which this end is to be gained is by *securing*, for limited times, to authors and inventors the *exclusive* right to their respective writings and discoveries. The right is recognized as inherent: Congress is to secure that right for a term of years, on condition of its free surrender at the close of the term. To this test every clause in the proposed amendment should be brought before any time is wasted on the discussion of its general capacity for good or evil. Will it aid in promoting the progress of science and the useful arts? and will it aid in securing to the inventor the exclusive control of his invention?

The experience of this country has been that the surest way to promote progress in the arts is through the encouragement of invention; and that inventions are best encouraged by securing to the inventor his right to his own, at the least expense in time and trouble and money. As Commissioner Hoyt has expressed it: "From the very foundation of this government, it has been its settled policy to secure a just reward to all inventors; and it is to the inflexible maintenance of this policy that we are indebted for the unparalleled advancement which, as a people, we have made in the useful arts. All that is glorious in our past or hopeful in our future is indissolubly linked with that cause of human progress of which the inventors are the *preux chevaliers.*"

That the policy of the nation has been wiser as well as juster than many people (even among the agents of government in Congress, in the courts, and in the Patent Office) have always approved, is only too true. Witness the grievous injustice that has been done to some of the noblest and most beneficent of our inventors in the markets and in the courts; witness the grievous injustice to all inventors threatened in the proposed changes in the law now before Congress; but the constitutional principle remains. Congress has power only to make the inventor's exclusive right *secure.* Congress has no right under the Constitution to impose needless burdens upon the patentees, or to interfere with the patentee's unrestricted right to the use and profit of his invention after he has surrendered his specification.

That the proposed amendment of the law undertakes in various ways to accomplish both these unjust and impolitic ends has been shown repeatedly in these columns, particularly with reference to sections two and eleven. Indeed the hand of the infringer is so plainly visible in these, and to a less degree in section one and some of the other sections, that the bill should be overwhelmingly defeated unless these features are stricken out. The single fact that the parties chiefly interested in its passage are not inventors, but those who wish to profit by the inventions of others without being called to account therefor, should arouse inventors, and the public so greatly benefited by their labors, to the necessity of bringing public opinion on this important matter to bear forcibly and promptly upon their representatives in Congress. The American patent system is intended to benefit the public, as a whole, through the protection of inventors. The obnoxious features of the proposed amendment are intended to benefit a few, through the protection of infringers, through the limitations of inventors' rights, through the summary confiscations of the inventions of poor men. The choice between the system as it is and as the change would make it, would seem to be an easy one to make by all clear headed and honest men.

THE ESTABLISHMENT OF PUBLIC TOWN LIBRARIES.

At the late Conference of British Librarians in London, the last resolution adopted was, that "the Council be recommended to take all opportunities of influencing public opinion in favor of the Public Libraries Act." The power given by this law of 1851 to towns, annually to raise money by local tax to maintain free libraries, has been very acceptable to the people; and it is an evidence of it that, at the end of twenty-five years, every large town in Lancashire has established one. At the last conference of American librarians also, the same spirit was manifested. A committee was appointed to devise measures for the increase of town libraries, and to report a suitable form of law in respect to them adapted for enactment by those States which have not yet had any law upon the subject. By such action librarians show that they are not discharging their daily duties as mere perfunctory officials, but that they possess at least as much of the emotion of warm benevolence for the common weal as characterizes any other class of public servants. Indeed in the mention which was made in the American conference of the importance of the multiplication of town libraries, the duty of aiding in forming them was frequently alluded to by the speakers as having the dignity of a missionary enterprise. The advancement of this great work cannot justly or successfully be left to depend upon librarians: there are no supernumeraries among them. It must be set in motion by the citizens of individual towns. And we know of no class of persons in the community who can be more efficient in giving an impulse to such a movement in the towns where they live for the establishment of a public library than the

readers of the SCIENTIFIC AMERICAN. They have the education, the energy, and force of character to produce the most substantial results; while, at the same time, there is no class who would reap more solid advantages from these institutions than they would. In such a library, maintained in a village of, we will say, not more than two thousand inhabitants, there would be provided, besides the books for circulation to be read at home, for the public reading room, the best encyclopedia of a general character at the outset, and gradually afterwards encyclopedias of specialties, of agriculture, civil engineering, and all the arts and the natural and physical sciences.

It must be acknowledged that though we have reason to suppose that all would echo their approbation of the project of a library to be maintained at the expense of the town, yet in each locality the impulse must be given and sustained by the activity of one or two earnest minds. Thus in Massachusetts, more than a third of the three hundred and forty-six towns have availed themselves of the powers and privileges of the public libraries law, also like the English of the year 1851. But Texas, which has also passed a law allowing towns to tax themselves for the like purpose, lacks the zealous citizens in each large town to make the law effective.

It is not known to more than a very small proportion of the voters of the State of New York, that for seven years past, since 1872, there has been a law on the statute book giving the towns and villages of the State the right to tax themselves to sustain a public library. We should be happy to obtain the name of any town where a public library has been founded and maintained under the provisions of that law. This result shows that merely to secure wise legislation is but a small part of the work which is necessary to be done to secure reading for adults as public and free as is the public school for children.

Men who are longing for libraries for their own towns may often find that existing laws give greater facilities for action than they have supposed. Let them seek for active co-operators among their fellow citizens; let them seek for donations and bequests, or the transfer of some library association to the town, that the new enterprise may start off on a broad and solid foundation.

FOREST CULTURE PAYS.

That in the long run it would pay to reclothe the waste and untillable lands of our country with forest trees, no one doubts. Future generations will need wood and timber, need it badly, we fear; and it will be doing the future good service to make provision for their wants now. No one doubts that; but very few care to labor for that end in the absence of more immediate remuneration, and very few are aware that it is not necessary to wait a hundred years for a timber crop to pay. The writer has not yet struck the downward slope of age, yet he has seen large areas of timber land cleared three times; and the second and third growths have yielded a larger body of wood than the original forest. This without specific cultivation.

With cultivation, Mr. Richard S. Fay, in Essex county, Massachusetts, has demonstrated that a forest crop will begin to pay expenses in a very few years, and in the course of ten years will bring in a handsome profit on the whole capital expended. Some thirty years ago Mr. Fay planted an untillable portion of his estate near Lynn with European larch and other forest trees. Up to a year ago the thinnings from this plantation, according to the Massachusetts *Ploughman*, yielded some seven hundred cords of firewood, besides a large amount of fencing material. Last winter the thinning produced:

175 cords of firewood, sold at an average of $5.50	$962.50
500 larch posts, 25 cents	125.00
51 larch telegraph poles, $1	51.00
100 larch railroad sleepers, 50 cents	50.00
	$1,188.50

The area planted is not given; it was, however, worthless for regular agricultural uses, and as the crop of last year is likely to be repeated from year to year, without diminishing the final crop, the investment is looked upon as fairly profitable. We are happy to believe that in many portions of the Eastern States the area of timber land is greater than existed twenty years ago. Still there are thousands of barren acres in almost every county, that would speedily become a source of profit, if the owners could be made to realize the advantage of planting trees, or of protecting the early natural growths from the depredations of sheep and cattle.

HARBOR OF REFUGE ON THE PACIFIC COAST.

There is a project before Congress to build a harbor of refuge somewhere between San Francisco and the Strait of Fuca. These points are over 700 miles apart, and yet between them there is not a single harbor that can be entered in a southerly gale. There are, it is true, many open anchorages scattered along the coast between these places, which afford reasonably good protection for vessels against the northwest winds and seas that prevail in summer, but there are none that a vessel can enter in heavy weather when the wind is south, southeast, or southwest, as it frequently is in the winter season. The want of such a harbor of refuge will be seen when we state that since January, 1861, no less than 427 disasters have occurred to the shipping on the Pacific coast north of San Francisco, whereby hundreds of lives and millions of dollars were lost, many of which might have been saved had there been a suitable harbor of refuge.

There are three convenient places where a harbor might be made, namely, Port Orford, Coos Bay, and Foulweather Cape. The first of these is just about half way between San Francisco and the Strait of Fuca; Foulweather Cape is 120 miles to the north; and Coos Bay between the two. Surveys have been made by government engineers of Port Orford and Foulweather Cape, but for some reason not explained Coos Bay has not been examined, or at least no report on it seems to have been made.

Port Orford appears, from its geographical position, to be the best place for the harbor. It is easily accessible, presents a deep and capacious roadstead, offering secure anchorage from gales from all points except south, southeast, and southwest; the land around is high and prominent and presents all the materials easily accessible for a stone breakwater. All that is now needed to make it a secure harbor of refuge at all seasons is a breakwater, behind which vessels can ride safely at anchor during gales from the south, southwest, and southeast.

The government engineer, Major Wilson, states that a breakwater 5,000 feet long would secure a harbor of about 300 acres, and would give ample protection to a large fleet during the heaviest gale. Such a breakwater is estimated to cost $9,405,000. It is thought, however, that for present purposes a shorter one could be built of about 2,000 feet, for $3,427,000, and this could be extended when necessary.

Cape Foulweather, the other place proposed, is a promontory whose crest line runs from east to west at right angles to the general line of the coast, making bays to the north and south. On the north the shore line is crescent shape, the outer extremity pointing north, a reef making out from it in a direction north-northeast a distance of about 5,000 feet, terminating at a lone rock about 1,800 feet from the beach. The depth on this reef varies from 10 to 30 feet, except for a distance of about 1,200 feet near the cape, over which there is a channel of that width and of a depth of from 30 to 40 feet. By building a breakwater from the extreme point of Cape Foulweather northward inside of the reef above described for a distance of 600 feet, a very good harbor would be secured. This would inclose an area of about 100 acres, under the lee of the cape, with good anchorage in from 4 to 8 fathoms of water. It is believed that this small breakwater could be built in that locality for about $670,000, and that the harbor would be sufficient for the present. If desired at any future time it could be enlarged by extending the breakwater along the reef. This harbor with the 600 feet of breakwater would, however, only be available in south and southwest gales, but during heavy weather from the northeast vessels could anchor on the other side of the cape.

Another plan proposes that a breakwater some 9,900 feet long shall be built on the south of Cape Foulweather, starting from Zaquima Head below the cape, running west, and then curving to the north. This would inclose about 1,000 acres, but its cost would be very large—over $11,000,000.

THE SOCIAL SCIENCE CONVENTION.

The annual meeting of the American Social Science Association was held in Boston, January 8. The meeting was opened by the reading of a letter from the president, David A. Wells, explaining his absence and reviewing the progress and opportunities of social science. Never before in the history of the world have so many and so important questions—fiscal, economic, educational, sanitary, and moral—pressed themselves upon the attention of the public.

The steamship, the railroad, and the telegraph are breaking down the old and formidable barriers of nationalities, and, for the purpose of business, are making the whole world one country, a condition of things under which the great fundamental truth of modern political economy, that nations and individuals are alike benefited and never injured by the prosperity of their neighbors, will be more than ever manifested. All methods of production and exchanging are also undergoing modification, with the certain result, which no legislation can prevent, even if it were desirable that it should, of economizing labor and material, and the cheapening of production. During, and in consequence of these changes, and for years yet to come, there will be much of discomfort, and undoubtedly also of suffering, from the displacement of individuals from occupation and their readjustment in new positions or locations. Millions of capital now useful and returning an income to their possessors, are certain, in the no distant future, to be also made worthless, as the course of improvement requires that they shall be, in order that protection may be cheapened and made better. But the ultimate result will be undoubtedly greater abundance, less poverty, and a higher elevation of the race. To forecast the course of economic agencies and events; to help make the burden of disturbance and change in occupation less grievous to the people; to help overcome that moral inertia among the masses which greatly prevents them from helping themselves, and accommodating themselves with rapidity to the demands of progress, are all questions and problems preeminently within the domain of social science.

And if there is any advantage in associated efforts over individual and isolated effort, in the way of determining and disseminating truth, then, Mr. Wells concluded, the American Social Science Association has the largest of opportunities before it for future benefaction.

Perhaps the most remarkable paper read before the association was that of Mr. George T. Angell, of Boston, on "Public Health Associations in Cities," and it was remarkable chiefly as a tissue of extravagant assertions with regard to the adulteration of foods, drinks, medicines, and so on. The single fact that men do eat and drink and live is proof that matters cannot be anywhere near so bad as Mr. Angell asserts. He says in one place:

"Several mills in New England, and probably many elsewhere, are now engaged in grinding white stone into powder for purposes of adulteration. At some of these mills they grind three grades—soda grade, sugar grade, and flour grade. I am told that thousands of tons of it have been ground in one town of Massachusetts. It sells for about half a cent a pound."

Statements like this would have had some weight if Mr. Angell had merely taken the trouble to procure some of the ground stone for exhibition, with samples of soda, sugar, and flour containing it. How does Mr. Angell know that the thousands of tons of ground stone furnished by his single Massachusetts town are not used for perfectly legitimate purposes?

Again, with regard to milk, Mr. Angell says: "It is not water alone that is mixed with milk. Thousands of gallons, and probably hundreds of thousands, are sold in our cities which have passed through large tins, or vats, in which it has been mixed with various substances. Receipts for the mixture can be bought by new milkmen from old, on payment of the required sum. I am assured, upon what I believe to be reliable authority, that thousands of gallons of so-called milk have been, and probably are, sold in this city which do not contain one drop of the genuine article."

Our knowledge of Boston milk is but the slightest. It may be very grievously adulterated; but a single pint of imitation milk containing "not one drop of the genuine article" would have been worth more as evidence of adulteration than twenty columns of Mr. Angell's unsupported assertion. On such points social science demands facts, not what any man simply believes. Again, Mr. Angell says: "A large portion of our California wines are made in Boston cellars." Mr. Angell ought to have been able to furnish a shadow of evidence of such an extensive industry—if it had any real existence.

If the Social Science Association desires to secure or sustain a reputation for scientific spirit and character, it should insist that the honor of American industry shall not be thus ruthlessly assailed at its conventions, without abundant proof that the speaker knows what he is talking about, and is not given to reckless exaggerations. It should not allow its meetings to be made the spouting place of sensationalists and fanatics. Personally Mr. Angell may be all that his name implies; we have no knowledge of him whatever; yet we do not hesitate to say that he has grievously overstated his case. The cause of honest dealing is not advanced by such wholesale charges of criminal misdoing on the part of traders generally. That more efficient means should be adopted throughout the country for detecting and punishing adulterations, we are ready to admit; nevertheless we are persuaded that it is easily possible to furnish our tables with pure and wholesome meat and bread and wine—even with pure coffee, and pickles without copper—in spite of Mr. Angell's assertions.

SETTLEMENT OF A DOUBTFUL GEOLOGICAL POINT.

The use of the term "Hudson River Group," proposed by the New York geologists to designate the upper two members of the Lower Silurian system—the Utica and Hudson river shales—has long been a debatable point among other geologists. This term was rejected some years ago by Messrs. Meek and Worthen, on the ground that these rocks did not reach the Hudson river, and hence it was a misnomer. They proposed the substitution of the term "Cincinnati Group," on the supposition that the Lower Silurian limestones were the equivalents of the so-called Hudson river rocks of New York. This change was accepted by Professor Dana and other geologists, and thereafter in the current classification of the Lower Silurian the upper members were called the "Cincinnati Group."

Subsequently, however, Professor James Hale and Sir William Logan made an examination of the Hudson river region, which led to a clear recognition of the slates and sandstones of the Hudson river group on both sides of the river, as originally designated and limited in signification by the New York geologists, and constituting by itself the entire mass of the formation. On the west side of the river they traced the formation as far as Kingston, and on the east side as far south as Rhinebeck, which they supposed to be its eastern limit. In the geological map drawn by these gentlemen and appended to the report of the Canadian Geological Survey, the rocks on both sides of the river, from Rondout on the west and from Rhinebeck on the east, extending southward, are designated as Calciferous and Levis. In regard to the latter rocks, Dana observes, in his Manual of Geology, that as they have afforded no fossils, their age is still doubtful. We learn now, however, from the Proceedings of the Poughkeepsie Society of Natural Science, that this doubt has been set at rest. Professor T. N. Dale, in a paper read before that society December 4th, stated that he had detected an abundance of fossils—brachiopods, univalves, crinoids, and fucoids—in both the rocks around Poughkeepsie and in those on the opposite side of the river. These Professor Hale identified as peculiar to the Hudson river group. This would seem to settle the fact that the New York State geologists were correct in their first determination of this formation. A statement of Professor Dale's discoveries also appears in the *American Journal of Science and Art*, for January, 1879.

Train the Boys for Business.

There is one element in the home instruction of boys to which, says a Boston paper, too little attention has been given, and that is the cultivation of habits of punctuality, system, order, and responsibility. In too many households boys from twelve to seventeen years are too much administered to by loving mothers or other female members of the family. Boys' lives during those years are the halcyon days of their existence. Up in the morning just in season for breakfast; nothing to do but to start off early enough not to be late; looking upon an errand as taking so much time and memory away from enjoyment; little thought of personal appearance except when reminded by mother to "spruce up" a little; finding his wardrobe always where mother puts it—in fact, having nothing to do but enjoy himself.

Thus his life goes on until school ends. Then he is ready for business. He goes into an office where everything is system, order, precision. He is expected to keep things neat and orderly, sometimes kindle fires, file letters, do errands—in short, become a part of a nicely regulated machine, where everything moves in systematic grooves, and each one is responsible for correctness in his department, and where, in place of ministers to his comfort, he finds task masters, more or less lenient, to be sure, and everything in marked contrast to his previous life.

In many instances the change is too great. Errors become numerous; blunders, overlooked at first, get to be a matter of serious moment; then patience is overtasked, and the boy is told his services are no longer wanted. This is his first blow, and sometimes he never rallies from it. Then comes the surprise to the parents, who too often never know the real cause, nor where they have failed in the training of their children.

What is wanted is for every boy to have something special to do; to have some duty at a definite hour, and to learn to watch for that time to come; to be answerable for a certain portion of the routine of the household; to be trained to anticipate the time when he may enter the ranks of business, and be fortified with habits of energy, accuracy, and application, often of more importance than superficial book learning.

The Emery Mines of Chester Co., Pa.

In his communication, printed in our issue of November 2, W. J. L. spoke of the emery mines near Unionville, Chester Co., Pa., as having been abandoned for lack of mineral of marketable purity. Mr. Isaac J. Conner writes that the mines in question "have never been abandoned, only at short intervals, for the last nine or ten years," and that there are at present three different parties actually engaged in mining the mineral in that locality. The purity of the emery of Chester Co., Pa., is, he claims, unsurpassed. It was there, on the premises of Messrs. Chandler & Ball, four or five years ago, that the largest and best mass of emery ever found on the continent was discovered—a solid block weighing about two hundred tons.

A NEW SQUARING SHEAR.

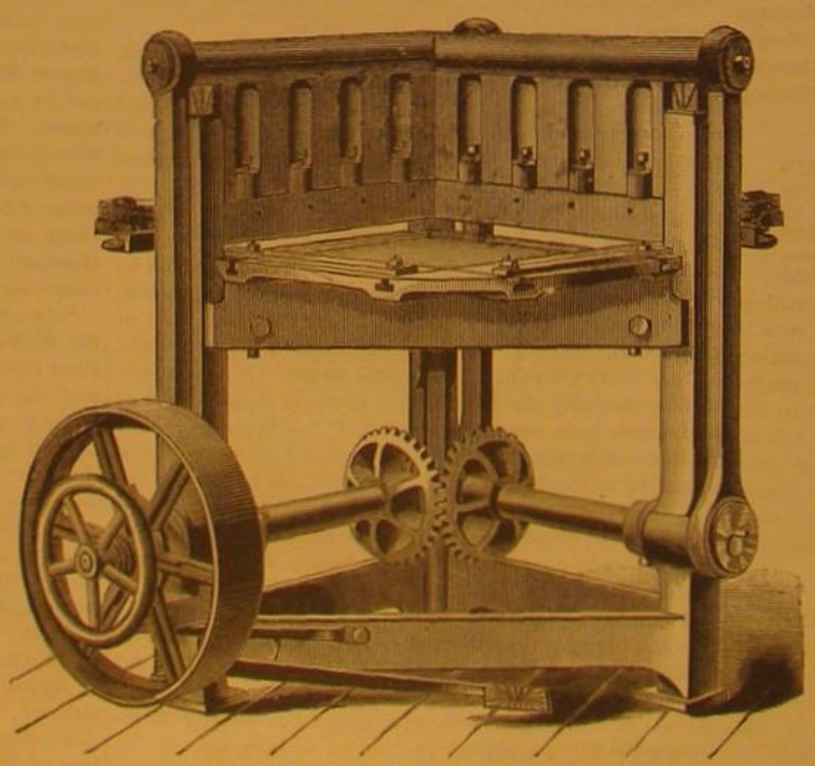
The operation of squaring a sheet of metal when performed by means of ordinary shears requires four movements of the sheet and a careful adjustment of the metal to the gauges. The accompanying engraving represents the new power shear manufactured by the Stiles & Parker Press Company, of Middletown, Conn., by which this operation is facilitated and rendered accurate.

This shear has two blades, each 22 inches long, set at right angles one with the other, and moving in unison, so that a sheet of tin can, with one motion, be squared on two sides, or the whole sheet squared in two motions. As will be seen by the engraving, there are suitable front gauges as well as independent back gauges, one for each blade.

The gauge on one blade can be set to cut a different width from the other, so that a part of a sheet of metal can be cut up into a certain width for one article, and the remainder into a different width for another article, resulting in the saving of stock.

The frame that holds the upper blades is carried down uniformly, by three pitmans, located one at the extreme end of each blade, thus securing a perfectly smooth cut.

The shear has the patent gib arrangement which this firm have applied to their presses. It is also provided with an automatic stop motion which leaves the blades wide open.



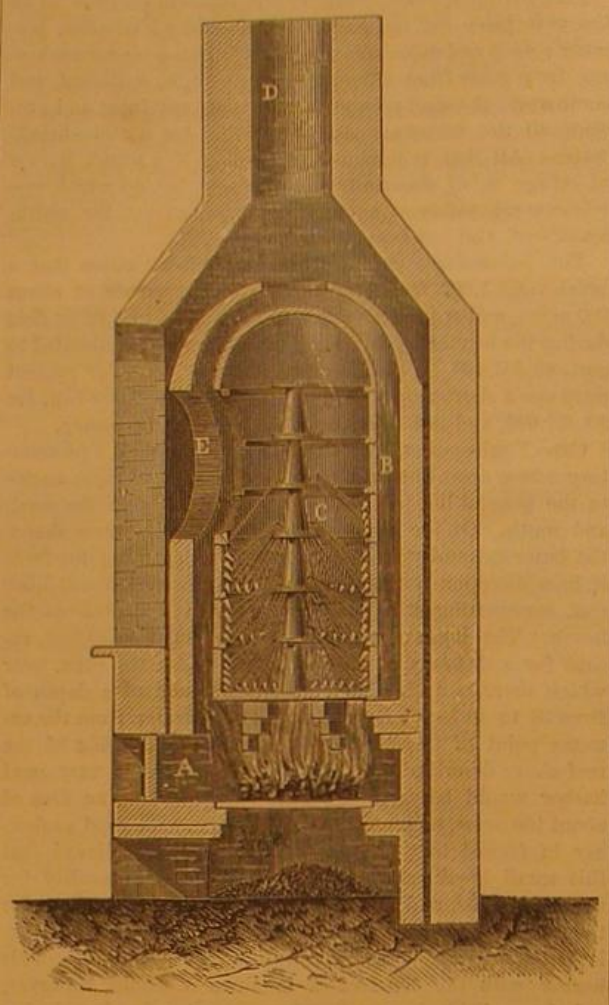
STILES' NEW POWER SQUARING SHEAR.

Quicklime a Wood Preservative.

The *Builder* states that M. Lostal, a French railway contractor, recommends quicklime as a preservative for timber. He puts the sleepers into pits, and covers them with quicklime, which is slowly slaked with water. Timber for mines must be left for eight days before it is completely impregnated. It becomes extremely hard and tough, and is said never to rot. Beech wood, prepared in the same manner, has been used in several ironworks for hammers and other tools, and is reputed to be as hard as iron, without the loss of the elasticity peculiar to it. According to the *Kurze Berichte*, lime slaked in a solution of chloride of calcium is used at Strasburg as a fireproof and weatherproof coating for wood.

CLAY PIPES AND THEIR MANUFACTURE.

Tobacco and the pipe are articles the habitual use of which has become general all over the globe, in imitation of the former inhabitants of America. Among the branches of industry which have been a consequence of the introduction of tobacco, the manufacture of pipes has become of considerable importance. Immense quantities of wood,



PIPE-MAKER'S OVEN.

meerschaum, china clay, and pipe clay are annually converted into pipes, principally in England, France, Germany, and Austria; a smaller quantity being produced in Holland and Turkey. Wooden, china, and meerschaum pipes are made mostly in Germany and Austria, and among clay pipe producers England takes the first rank. Although the value of clay pipes is comparatively small, the enormous quantity in which they are made makes them an important product of industry to England.

The principal pipe factories are located in Dorsetshire and Devonshire, where a pure variety of potter's clay is found in great abundance. It resembles kaolin in its character, although it contains a little less silica, and remains quite porous after baking. The clay is first freed of all impurities by levigation, and then undergoes repeatedly a process of kneading and curing in open tanks, exposed to the air, in much the same way as clay for other purposes is treated. After it has acquired the desired plasticity, it is divided into masses of about 50 lbs. each, which are then given to the formers.

The first step in making a pipe is the formation of the stem in a metal mould. A small lump of clay is left attached to the rod, of which the cup is afterward formed. The rod is then pierced throughout its length with an oiled brass rod. Holding the pipe by the free end of the stem, the operator now imparts to the cup its external form by means of a copper mould, in which if ornamental pipes are to be made are engraved the designs. It is provided with a spring to open it automatically. The pipe then passes to a third operator, who forms the inside of the cup with his fingers and establishes communication between the cup and the stem by piercing the separating wall with the brass rod. The pipe is now put aside to dry in the sun, after which it is ready for the oven. Three men finish from 600 to 700 pipes a day.

The accompanying engraving represents an oven used by English pipemakers. The fire, A, is located centrally in the oven. The heated gases circulate through the space, B, formed by the walls of the oven and by the muffle, C, which receives the pipes. The latter are introduced through the door, E, and arranged in the position indicated by the engraving, on shelves made of biscuit. An oven of this kind usually contains 2,000 pipes. The pipes are generally baked for eight or nine hours.

Ordinary pipes receive no glazing of any kind, while some of the better class are painted and glazed. They are very porous, hence their tendency to adhere to the lips. To overcome this the mouth ends are dipped in water containing a little pipe clay in suspension, and polished. By this means the pores of the clay are stopped. Pipes of better quality are covered with a mixture of soap, wax, and gum, and then polished.

Difficulty is occasionally experienced in holding the pipes in proper position in the oven. Some manufacturers fill the oven with fine sand after the pipes are in position. The sand fills all interstices and supports the pipes.

Several millions of dollars' worth of clay pipes are annually manufactured in England.

Fortifying the Sub-Treasury.

The great amount of bullion which is concentrated at the Sub-Treasury, in this city, has suggested to the officials the desirability of strengthening the vaults, and taking other means of protecting the vast treasures within the building. To this end Mr. George L. Damon, of Boston, has been selected by Secretary Sherman to do the job.

The improvements will consist of steel gratings, iron bars to the windows of the three floors, wrought iron doors with loopholes, and three steel turrets similarly perforated to be placed on the roof. The center turret is to be octagonal in shape, and will occupy a commanding position in order to enable marksmen to sweep the roofs and the streets below in case of an attack by an armed mob. It is also understood that the Assay Office will be similarly protected, and in addition will be supplied with a Gatling gun. These precautions were first suggested at the time of the great railroad strike two years ago.

Machinery for the Manufacture of Toys.

Toy making by hand cannot bear high wages for labor nor high prices for wood. Hence the most important centers of the toy industry were established on the high mountains of Germany and Switzerland, where forests abound and the population were willing to work long hours for small pay. What can be done in the way of cheap production is illustrated at Leiffen, in Saxony, in a manner almost terrible. For making 180 toy kitchen utensils, as they are usually furnished to this country, *three* cents are paid. Sixty small boxes for packing these toys are paid for with from ten to fifteen cents. The making of wooden toys is almost the sole industry in many parts of central Europe, and the united labor of all, from the grandchild to the grandfather, formerly sufficed to obtain for the toiling families only a bare subsistence.

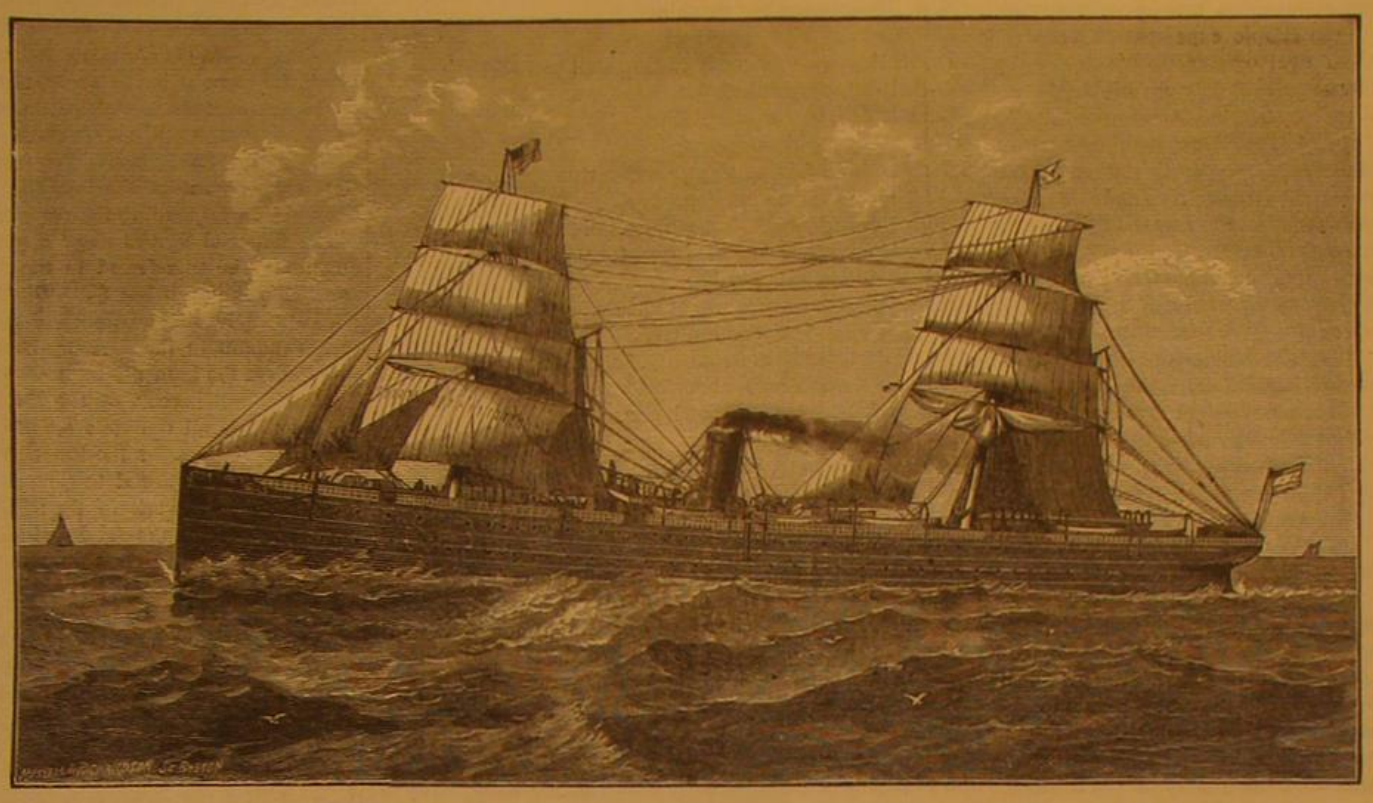
Here, one would think, if anywhere, the introduction of machinery would prove disastrous to hand labor. With the machinery now employed one man, working one machine ten hours a day, can turn out an amount of work which was formerly accomplished by a whole family working from eighteen to twenty hours a day for several weeks; and during recent years such machinery has been widely and rapidly introduced in the toy-making regions.

What has happened? The starvation of the poor hand-worker? That ought to be the result, if the socialist's objections to machinery were true; but such is not the result. On the contrary, the condition of the toy makers has been directly improved by the influence of machinery. In this way: The cost of toys, small as it used to be, has been enormously reduced, and the market for toys correspondingly widened. And though machinery now does the larger part of the work, the amount of work to be done has been so increased that the demand for handwork, in putting the parts of the toys together and the like, has been largely augmented. The result is the employment, at fair wages, of all the population, including aged people, cripples, and children, who otherwise would have nothing to do. Besides, the multiplication of factories has brought the scattered peasants together, schools have

been established, and artistic taste has been developed in a way to make the work done of greater value and more attractive, with a corresponding increase in the value of labor. From Nurnberg alone there are now sent out some 23,000 tons of toys, the price lists of which number 16,000 different designs. Since the introduction of steam machinery into the toy industry of this place the annual product has increased twenty-fold. At Sonneberg, in Thuringia, not long ago a small hamlet, but now quite a city, the annual production of toys amounts to some $10,000,000.

THE NEW WOODRUFF SCIENTIFIC EXPEDITION.

Bacon's ideal college was surrounded by a park, which should contain the "raw materials" of all knowledge. The tendency of education in recent years has been to make Bacon's ideal real. Witness the splendid grounds, museums, libraries, and in many cases elaborate workshops, attached to our representative institutions of learning. But the world can not be brought within the compass of a park. The raw materials of knowledge are not all transportable. Consequently, he who would study man and nature at their best, in the fullness of life and activity, must pursue the quest of knowledge the world over. Accordingly Mr. Woodruff would outdo Bacon, make the whole world his park of learning, and carry his college around the globe.

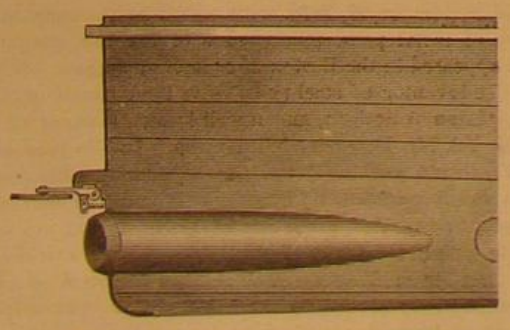


THE STEAMER GENERAL WERDER OF THE NEW WOODRUFF SCIENTIFIC EXPEDITION.

That an enterprise so novel and radical in character should meet with many obstacles, is not to be wondered at, nor that it should have taken nearly three years for its managers to reach a point at which they could say "we are ready." It is to be hoped that no lack of candidates will prevent the sailing of the expedition so liberally planned and fitted out. The accompanying engraving shows the steamer General Werder, selected for the voyage, and certified by the United States Navy Department as suitable in all respects for the purposes of the expedition.

The Director wishes it to be distinctly understood that the expedition is neither a money making speculation, nor yet a visionary philanthropic scheme; but an educational enterprise of great magnitude and importance, conducted on sound and legitimate business principles. The managers have no other pecuniary interest in the expedition than to make it self-sustaining. It is expressly provided by Act of Congress that no mercantile or commercial venture shall enter into the plan of the voyage. The financial basis of the enterprise is perfectly sound. Every possible assurance of the fulfillment of their contract is given by the managers, who are bound, by every provision that could be reasonably required, to the exact terms of the agreement between themselves and the patrons and trustees of the expedition.

The collegiate department is to be under the control of President W. S. Clark, LL.D., of Amherst, Mass. The ship will be commanded by Commander A. P. Cooke, United States Navy; while the financial affairs of the expedition are intrusted to Drexel, Morgan & Co., bankers of this city.

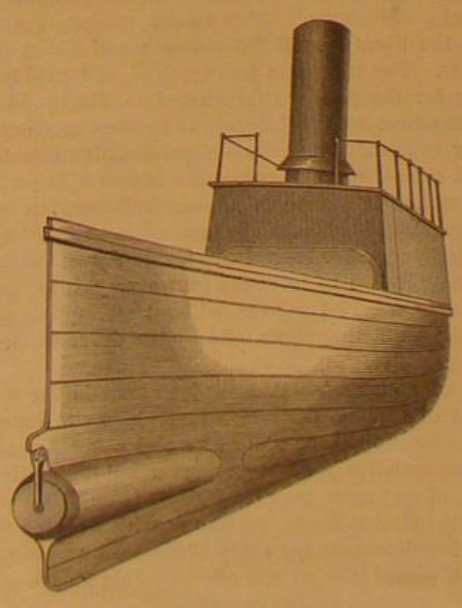


BOW OF THE "DESTROYER."

The whole plan and purpose of the expedition is educational. It involves a voyage around the world, to be performed in sixteen months, devoted to the education of youth and the recreation of tourists. For the students the expedition will constitute a floating college, in which the usual course of instruction will be complemented by object teaching on a grander scale than has ever before been attempted, while to the tourist it offers many advantages for sight seeing.

The expedition will visit the principal points of interest on a carefully considered route around the globe. The commerce, manufactures, arts, manners, and customs of the principal nations of the earth may be successively compared, and their elements of strength or weakness be ascertained by actual observation. The geology, geography, zoology, and botany of many foreign countries will be investigated by the scientific corps. Extensive collections in the various departments of natural history will be brought home, which will serve to enrich our National Museum, and may become the basis of important scientific publications. Special attention will be paid to instruction in mathematics, navigation, and practical astronomy. The knowledge to be acquired on this expedition is, in short, equally adapted to the requirements of the professed scientist and the man of business.

The route selected has been decided upon, after mature deliberation, as one most likely to bring the party to the different ports at the most favorable seasons of the year. In planning the course of the vessel, all that careful foresight can provide for has been taken into account, yet it is scarcely to be expected that every step of the projected route can be followed. It is not possible to participate and provide against chance of detention with such certainty as to foresee the precise time of reaching and leaving a given port. It may become necessary to modify the proposed route in some of its details; but the managers give the strongest and most positive assurance that no expense will be spared and that no effort will be wanting to conduct the voyage in good faith according to the letter and the spirit of the programme announced. As already said, the voyage will take about sixteen months, which length of time is deemed sufficient for the full attainment of the objects of the expedition. It is estimated that about three quarters of the time will be spent in port. Numerous inland excursions for study and observation will be made at the expense of the management and under the guidance of the Faculty.



EXTERIOR OF THE "DESTROYER."

The fee to be paid by students and tourists is fixed at $2,500. Expenses when away from the ship, washing bills, and other personal matters extra. It is proposed that the expedition shall sail May 8th next, and return in September, 1880. The chosen vessel is certified by the Navy Department to be staunch and commodious in every particular. It is 360 feet long, 40 feet beam, 3,000 tons burden, brigrigged, with compound engines of the latest type, and duplicates of all machinery, screw, etc., liable to accidents. It is provided with spacious accommodations, the best ventilation, a full complement of boats, and every modern appliance for health, safety, and comfort.

Recuperating the Brain.

An intelligent writer on this subject thinks the use of stimulants to fortify the exhausted brain an unwise measure. The best possible thing, he says, for a man to do when he feels too weak to carry anything through is to go to bed and sleep as long as he can. This is the only recuperation of the brain power, the only actual recuperation of brain force; because during sleep the brain is in a state of rest, in a condition to receive appropriate particles of nutriment from the blood, which take the place of those which have been consumed by previous labor, since the very act of thinking burns up solid particles, as every turn of the wheel or screw of the steamer is the result of consumption by fire of the fuel in the furnace. The supply of consumed brain substance can only be had from nutritive particles in the blood, which were obtained from the food eaten previously, and the brain is so constituted that it can best receive and appropriate to itself those nutritive particles during the state of rest, of quiet and stillness of sleep.

Large Magnet.

MM. Ducretet et Cie. exhibited at the Paris Exhibition a Faraday electro-magnet, alleged to be the most powerful ever made. The coils have a diameter of 50 centimeters (19·7 inches), and a height of 60 centimeters (23·6 inches). The total weight is 950 kilogrammes (2,193·6 pounds). The helixes are made up of numerous parallel and separately insulated wires in order to facilitate different combinations, both in tension and in quantity.

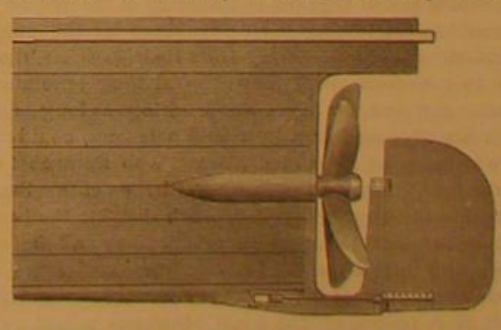
Correspondence.

Submarine Attack.

To the Editor of the Scientific American:

The excellent engraving of a submerged spar torpedo, inserted in the last issue of the SCIENTIFIC AMERICAN, will no doubt be examined with great interest by the nautical readers of the journal who have studied the subject of national defense against iron clad ships. The similarity of Admiral Porter's device introduced in the torpedo boat Alarm, and that which Mr. Ten Eyck presented to the Navy Department, as he says, 17 years ago, will call forth discussion regarding priority of invention and the relative merits of their systems.

Mr. Ten Eyck, although he declines to exhibit the "manner of working the spar," has shown the detail of the essential parts of his contrivance so clearly that the professional reader can have no difficulty in comprehending the simple and effective character of his manner of working the spar and exploding the torpedo. At the same time the engraving shows with sufficient distinctness that the projecting "snout" which surrounds and protects the spar arrangement is solid, and hence capable of sustaining the concussion with the enemy's ship during attack, unavoidable even at low speed. The snout of Admiral Porter's torpedo boat Alarm, it should be observed, lacks solidity, an important fact pointed out by the SCIENTIFIC AMERICAN of July 19, 1873. The editor, in analyzing the properties of the Alarm, observes: "Although built with a snout, ramming is only a secondary means of attack. In fact, the bow is not a solid piece, but



STERN OF THE "DESTROYER."

built out some twenty feet in order to allow the torpedo to be thrust forward well in advance of the boat." It needs no demonstration to convince naval architects that the snout ought to be, as depicted in Mr. Ten Eyck's drawing, perfectly solid. The complete destruction of the snout or ram of the German ironclad König Wilhelm in the British Channel, last year, by a very moderate concussion with its consort, Grosser Kurfurst, shows what would happen to the snout of Admiral Porter's torpedo boat during attack. The superstructure of the vessel forming a distinct element, it is not necessary on the present occasion to inquire whether by some mysterious process the peculiar deck-house of the Destroyer really appeared on the plan "submitted to the Naval Department" seventeen years ago. As to the spar employed by Mr. Ten Eyck, the method of passing the electric wire through the piston will be approved by practical men, also the plan adopted of guiding the motion of the spar by a tube, as it insures accurate movement under all circumstances. Nor will the simple expedient of introducing the torpedo through an oval opening at the top of the tube be overlooked by those who closely scrutinize the arrangement illustrated in the SCIENTIFIC AMERICAN.

But the assumption of Mr. Ten Eyck, that his plan of employing a spar torpedo resembles the system of submarine attack inaugurated by the Destroyer, is simply absurd. Whether the spar be permanently submerged, agreeably to the device of Admiral Porter and Mr. Ten Eyck, or suddenly submerged as practiced in steam launches, its action differs altogether from that of the projectile torpedo discharged by my torpedo vessel. The transverse section of this projectile torpedo, it should be mentioned, is square, and its length 23 feet, pointed at both ends, thus presenting opposite wedges whose sides are vertical. The weight is 1,400 pounds, and the initial velocity on leaving the torpedo vessel 290 feet per second, corresponding with a rate of 170 nautical miles per hour. The projectile, therefore, starts on its hostile mission with a kinetic energy or *vis viva* of nearly 2,000,000 foot-pounds, quite enough under all circumstances to propel the weapon a sufficient distance for effective attack.

From obvious reasons I decline furnishing a description of the mode of manipulating the destructive implement which the Destroyer has been built to convey, my principal object being that of exposing the absurdity of the assumption of Mr. Ten Eyck that his spar torpedo resembles my invention. It will be well to mention, for the information of those who are not familiar with the history of the torpedo, that I submitted to Emperor Napoleon III., during the month of September, 1854, drawings of a torpedo vessel provided with a submerged cylindrical chamber and appropriate valves for expelling a submarine projectile torpedo precisely as in the Destroyer, the only difference being that the projectile torpedo submitted to the French Emperor was cylindrical, 16 inches in diameter and 10 feet long, while the projectile of the Destroyer is square, and 23 feet long, as before stated.

J. ERICSSON.

Washington Correspondence.

To the Editor of the Scientific American:

The Commissioner of Patents has not at the time of this writing made out his report, but is hard at work upon it at such times as he can take from the current work of his office. It is understood that the report will be of much greater length than usual. The Commissioner is believed to be a hard worker, hearing all the appeals, etc., that he can himself, and hence his report may be a little later than usual.

Mr. Parkinson, the examiner in the class of harvesters, having resigned, Mr. J. B. Church was transferred from the class of metal working to fill this position, and Dr. Jayne, who formerly had charge of metal working, has resumed his old position. As Mr. Tilden, who formerly had charge of the household class, resigned some time since, there are two vacancies in the grade of principal examiner, which will be filled by a competitive examination which is to be held the first week in February.

CONGRESS.

The Senate is still engaged in tinkering at the patent law, and considerable talking has been done on the subject. Some of the Senators, judging from their speeches, did not appear to care how much they exposed their ignorance of the patent law and its beneficent workings so long as they, by their diatribes against patents and patentees, could curry favor with some of their constituents, who think that their interests are to some extent injured by patents. Senator Wadleigh made a very eloquent speech showing the benefits the patent law has conferred on this country and the world at large, and then urged the facts he presented as a reason for passing the present bill, which, in view of sections 2 and 11, will, if it passes, be the worst blow our patent system has had since its foundation. This seems about the same as using a eulogy on religion as a reason for passing a law to punish its professors. At this writing, section 2 is still under consideration, and it has received some pretty heavy blows from Senator Conkling, who appears to have a pretty good idea of the manner it would work in favor of the large corporations and against poor inventors.

There are as usual many applications for extensions of patents. Some of them are for patents that have already had an extension of seven years by the usual course of law, thus having had a life of 21 years, while others are of the seventeen year class, and have as yet had no extension. The following is a list of such cases as I could find:

R. F. Loper, improvement in shipbuilding.
Luther Hall, machine for shaping boot and shoe heels.
D. M. Cook, sorghum evaporator.
Alex. Twining, manufacture of ice.
E. W. Bullard, hay spreader.
A. F. Smith, locomotives.
S. S. Turner, sewing machines.
Aiken & Felthousen, sewing machines.
Nathaniel Jones, shoe lasts.
Edward L. Wilson, picture holder.
Hubbard & Conant, steam engines.
D. S. Stafford, cultivators.
M. Mattison, packing flour.
J. P. Clark, hydrants.
Florian Grosjean, sheet metal spoons.
L. F. Munger, locks.
Jas. Wyman, setting staples in blind slats.
Edgar Huson, wagon gear.
B. F. Rice, paper bag machines.
Sheldon Hartshorn, buckles.
David Heustis, method of casting shot and shell.
J. B. Read, projectiles.
Cook & Jenkins, working zinc.
Phillip Ulmer, camp spoons.
Asa Johnson, joining sheet metal for roofing.
M. A. Jones, pipe coupling.
Gilbert Jessup, seeding machines.
Van De Carr & Reynolds, brake for power looms.
Albert Fuller, faucets.
H. A. Stone, manufacture of cheese.
W. R. Fee, cotton seed hullers.
W. S. Carr, water closets.
Ira Pusey, platform scales.
McKay & Mathies, sole sewing machines.
Birdsell, clover huller.
C. E. J. Thornton, chain links.
A. R. Arnold, machine for making twist drills.
F. Cook, cotton bale tie.
Strong & Ross, weighing scales.

Very few, if any, of these will pass the ordeal of both houses. Some of them have already been reported adversely, and may never be heard of again, although there is no knowing what may be done toward the close of the session. One of the most important cases is that of McKay & Mathies, boot and shoe sole sewing machine, used in all shoe factories. This one would suppose to have been a very profitable patent, as the users of the machine, in addition to paying a good round sum for it originally, have to pay a royalty from a half to four cents (according to the style) on each pair of boots or shoes made on it. This case is being very quietly but skillfully managed by the patentees, counsel, and may require some good management on the part of its opponents to beat it.

There are two names in the above list, namely, Aiken & Felthousen, that have appeared in every list of applications for extensions for seven or eight years past, but so far have met with no success, and are not likely to, as their claims, if allowed, would give them a practical monopoly of the sewing machine business, because no machine could be made, which would now be used, without infringing their rights, if their patent was extended. There has been so much complaint about sewing machine extensions that every Congress so far has refused this one.

The report of the Librarian of Congress has just been sent in, from which it appears that the additions to the law department number 3,881 volumes, and to the miscellaneous department 17,656 volumes, besides 11,689 pamphlets and 2,344 maps and charts. This swells the aggregate contents of the library to 352,655 volumes and about 120,000 pamphlets. The copyright fees received and paid into the Treasury for the past year amounted to $13,134.50. The Joint Committee on the Library, at a recent meeting, gave authority to Senator Howe and Representative Cox to prepare and submit to their respective houses bills providing for the erection of a National Library building, but leaving the designation of the site to be inserted in each bill according to their respective individual views. By this action the Committee propose to leave the controversy as to the location to be settled by Congress, without attempting to harmonize the conflicting views held by the different members of the Committee.

Those of your readers who are interested in the non-employment of Chinese laborers, may be happy to know that the House Committee on Education and Labor has authorized Representative Willis to report a bill prohibiting the bringing of any more than ten Chinese in any vessel to any port of the United States, under a penalty of $100 and six months' imprisonment for every Chinese in excess of ten. The act if passed is to go into effect on July 1 next.

THE SUGAR QUESTION.

The Ways and Means Committee, after having listened for nearly a week to the leading men in the sugar trade, including merchants and refiners, came to the conclusion to report an amendment of the tariff, as follows: All imported sugars of the grade of 13 and under to be rated by the Dutch standard and pay a duty of 2·40. It now pays 2·19 for grade 7 and under, 2·50 for grade 10 and under, and 2·81 for grade 13 and under. This is all "refiners' sugar." On sugar between 13 and not over 16 the rate is to be 2·75 instead of 3·45, as at present. This is "grocery sugar," and can be used without refining. On sugar over 16, or refined sugar, the tariff is to be 4·00. The alleged coloring frauds being confined to sugars below 13, the adoption of a uniform rate for lower grade sugars leaves no incentive for coloring

PATENT AFFAIRS.

The business of the Patent Office during the year just closed shows a slight decrease, as will be seen on comparing the issues for the past two years, which are as follows:

	Patents.	Reissues.	Designs.	Trade Marks.	Labels.
1877	13,120	568	699	1,216	392
1878	12,345	509	590	455	492
Decrease,	775	59	109	761	Inc. 100

This shows a decrease in all the issues except labels, which exhibits an increase of 100. The difference in the real amount of business done is not so great as at first appears from the above, as instead of 52 as usual there are only 51 weekly issues included in the above list, owing to the change in the system of dating and issuing patents that was made at the close of the year. Had there been no change in the system of dating patents there would have been 53 issues in 1878, as there were that number of Tuesdays in the year, and this would have brought up the number of patents to nearly the same as in the previous year.

The applications for patents, including designs, were 20,260, against 20,308 in 1877; of reissues, 638; caveats, 2,755; trade marks, 1,577; labels, 700; and there were 832 cases forfeited for want of the final fee. These numbers nearly equal the corresponding figures in the year 1877.

The financial figures show a very large increase in the amount to be transferred to the Treasury. The receipts from all sources being $725,375.55, and the expenditures $566,916.39, leaving a balance of $158,459.16, which, added to the amount in the Treasury at the close of the previous year, leaves the immense sum of $1,272,680.56 now in the Treasury to the credit of the Patent Office. And yet our legislators are all the time scrimping and screwing down the appropriations for the Patent Office, until there is not sufficient money allowed to pay the proper number of men to do the current work of the office promptly, to say nothing of reproducing the old drawings, a work of great necessity, and from which the office would derive a revenue that would soon repay the present outlay.

The burnt model rooms are still covered only by a temporary roof, which leaks at every storm, and there are no signs of any attempts to change this condition of things, although nearly sixteen months have elapsed since the fire, and there are over a million and a quarter of dollars of Patent Office money lying idle in the Treasury. The office is very much cramped for space in consequence, and much of the work of the office has to be done in rooms not fit for use. The models are crowded in the cases so much that proper examinations of them cannot be made, and the very object of furnishing models is thus defeated. In view of this, it is to be hoped that our Solons will endeavor to look on the Patent Office with more favor, and allow the Commissioner at least enough of the Patent Office funds to conduct the business of the office, and that they will settle upon some mode of putting the Patent Office in fit condition for use.

It seems, however, almost hopeless to expect any better treatment from Congress, judging from the way they are now engaged in amending (?) the patent laws. It appears from the present signs that the bill now before Congress will pass with its obnoxious sections substantially as originally drawn by the lawyers of the great railroad and manufacturing corporations, for whose benefit it was originated, and whose agents have been sent here at a heavy expense to lobby it through. There are, it is true, some good points added to sugar-coat the pills, but the coating is entirely "too thin" to overcome the effects of the other noxious elements. The inventors of the country, and all who are interested in the progress of invention, should immediately see to it that Congress is thoroughly informed as to the evil workings of the bill, should it be passed in its present shape, or there is but little doubt that it will pass and thus work incalculable mischief.

Who Made the First Steel Pens?

To the Editor of the Scientific American:

The letter of Mr. G. A. Loomis, in the SCIENTIFIC AMERICAN of November 23, 1878, with regard to the early manufacture of metal pens, reminds me of the following note which appeared in the Boston *Mechanic* for August, 1835:

"'The inventor of steel pens,' says the *Journal of Commerce*, 'is an American, and a well known resident of our city (N. Y.), Mr. Peregrine Williamson. In the year 1800, Mr. W., then a working jeweler at Baltimore, while attending an evening school, finding some difficulty in making a quill pen to suit him, made one of steel. It did not work well, however, for want of flexibility. After a while he made an additional slit on each side of the main one, and the pens were so much approved that Mr. W. was called to make them in such numbers as to eventually occupy his whole time and that of a journeyman. At first the business was very profitable, and enabled Mr. W. to realize for the labor of himself and journeyman a clear profit of $600 per month. The English soon borrowed this invention, and some who first engaged in the business realized immense fortunes.'"

HENRY G. CHANDLER.

Concord, N. H.

ANEROID BAROMETERS.—The Giffard Captive Balloon, at Paris, has, it seems, been made to serve for some interesting experiments with aneroid barometers. It was discovered that all, or nearly all, the barometers, after registering the ascent, failed to record the difference in altitude until some time after they had been returned to the earth.

Vital Knowledge.

In a strong and feeling article on the distress among the laboring classes in England, and the urgent need of the most liberal contributions from the wealthy to relieve the suffering of the masses, the London *Times* lays great stress upon a principle of education too often overlooked by public teachers. "The education of the laboring classes has been terribly deficient in this most important respect, that the schools for their children, of whatever denomination, have scarcely made any endeavor to teach the principles of conduct, or to make the pupils understand, as matters of familiar knowledge, the inevitable effects of industry and of idleness. *Reading* and writing are, no doubt, important, notwithstanding how greatly their value depends upon the quality of the compositions which are read or written; but it is not less important, to any man whose probable future is that of a recipient of weekly wages, that he should know thoroughly the immutable truth, which no combination can falsify, of the general dependence of prosperity upon industry, upon thrift, and upon the use of opportunities. When we hear of working men, even now, refusing a wage upon which they might live, and which is all that the state of the markets will allow their employers to pay, because it falls below some arbitrary or ideal standard, it is almost as natural to feel anger at their perverseness as compassion for their stupidity. The question, 'Have they been taught better?' is one which should be answered before any judgment is pronounced upon the case. Unless this question can be answered in the affirmative, the ignorance which has been permitted to continue is hardly a ground for denial of help to the sufferers. The capitalized wealth of the country is not insufficient to bear the strain beneath which the active prosecution of industry has for a time succumbed."

New Agricultural Inventions.

Mr. James E. Wells, of Holmdel, N. J., has patented an improved Apparatus for Destroying Insects on Vines. It is particularly intended for applying to potato vines a mixture of Paris green and water for the purpose of destroying the Colorado beetle or potato bug.

Mr. John H. Simpson, of Stone Bluffs, Ind., has patented an improvement in the implement commonly known as the "A-Harrow," being formed of two diagonal tooth carrying bars connected by a transverse bar. The improvement consists in a novel method of connecting the several bars.

Mr. Alponso Record, of Farmington, Minn., has devised an improved Seed Planter, in which the holes of the dropping wheel will be so long within the seed box that the said holes will certainly become filled with seed before they come over the discharge holes.

An improvement in Cotton Seed Planters has been patented by Mr. Henry A. Walker, of Milton, N. C. This invention relates to machines for planting cotton and other seed The construction and arrangement of the parts of the apparatus cannot be explained without an engraving. The machine is substantial and effective.

A Large Contract for Iron.

The Phœnix Iron Company, of Pennsylvania, have completed a contract with the Metropolitan Elevated Railroad Company, of this city, for 80,000,000 pounds of iron girders, columns, braces, etc. which the Philadelphia *Ledger* estimates will cost $3,000,000.

One of the new roads of this company is to run on the Eighth and Ninth avenues to the Harlem river, a distance of four miles. The other branch will commence on Morris street, and along this street to Broadway, crossing that street at Bowling Green Park, through which it crosses to Beaver street, and thence to Pearl street, where it will connect with the present New York Elevated Railroad, and follow that to the upper end of Chatham Square; the new road will then branch off, passing up Division street to Allen, thence to First avenue, thence to Twenty-third street, thence to Second avenue, and thence to the Harlem river, making the distance seven miles. Most of the road is to be constructed so as to eventually receive four tracks, the cross girders to carry these tracks being 40 feet in length.

In putting this road up, it will be placed in the center of all streets over 55 feet in width from curb to curb, leaving space for carriages on each side, and with space underneath the elevated track for a double track street railway. Where the street is less than 55 feet between curbs, the columns will be placed on the edge of the sidewalk, and the girders will span the street, leaving the roadway unobstructed.

The Phœnix Iron Company, to complete these contracts, will keep their works in operation night and day. At present they have upon the pay roll 1,500 men, but in a few weeks this force will be increased to 2,000—a very encouraging state of things for the able-bodied men seeking work in those parts.

The shops and mills belonging to this company cover about six acres, in addition to the finishing shop, occupying a space of two acres more. There are twenty-one double puddling furnaces, and a contract has just been entered into for a mill containing eleven more, which, combined, will give a capacity of 800 tons per week of such iron as is used in constructing the elevated road.

During the time necessary to complete the work at the mills at least 60,000 tons of coal will be required. To facilitate the operations at night in the machine shop two of Brush's electric lighting machines are to be introduced.

A NOVEL OILER.

Nothing in mechanics demands more attention than the subject of the lubrication of journals. There are many lubricants, and numerous devices for applying them, but there are few of either that are not in some respect deficient. In the lubrication of machinery it is essential not only to do it thoroughly, but in these days of economy it must be accomplished with due regard to cost.

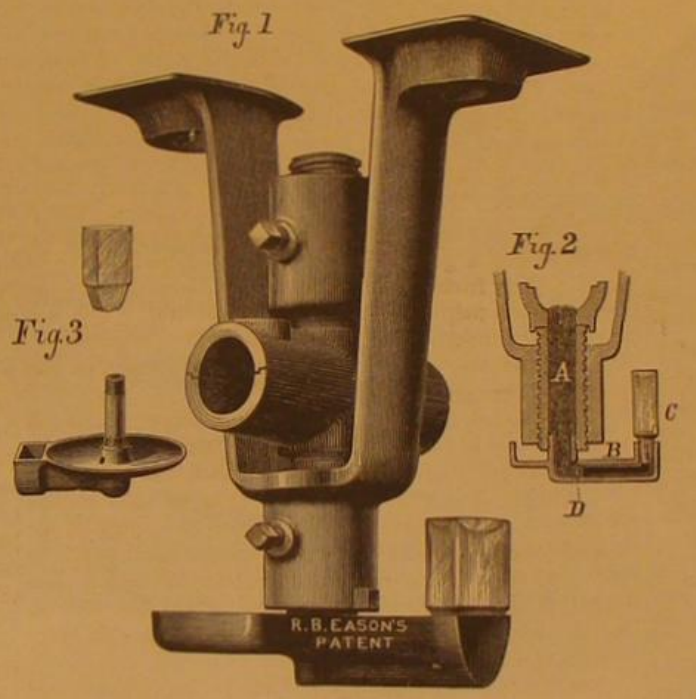
One of the most ingenious and apparently effective devices for continuously lubricating journals is shown in the accompanying engraving. In the arrangement shown in Figs. 1 and 2 the lower trunnion of the journal box is tubular, and has a filling, A, of cotton waste or other fibrous material, as shown in Fig. 2. Into the trunnion is screwed the nipple which supports the drip pan, B, and the passage formed in the bottom of the pan communicates with the nipple and has a vertical opening for receiving the neck of the bottle, C.

The nipple, which extends into the trunnion, is filled with cotton waste, so that when it is screwed into place the wick is practically continuous from the horizontal passage in the pan to the journal.

A small hole at D permits the oil that drips from the journal into the pan to re enter the wick tube and be again used.

In Fig. 3 is shown an oiler and drip pan adapted to an ordinary journal box. Its principle is precisely the same as in the one just described.

The bottle, C, is filled with oil, and inverted, and its neck is inserted in the mouth of the passage in the pan. As long as the horizontal passage in the pan is full the oil will not escape from the bottle, but when it is drawn by the capillarity of the wick so that the mouth of the bottle is exposed, a small quantity of air enters and a drop or so of oil escapes.



EASON'S DRIP-PAN AND OILER.

By means of this device oil is supplied to the journal just when it is needed, and every particle of oil is utilized. We are informed that this device has proved very efficient in practical use.

Further information may be obtained from the patentee, Mr. R. B. Eason, 135th street, between Alexander and Willis avenues, New York city.

Killed by Snakes and Wild Beasts.

The *Lancet* says that in the report on "Sanitary Measures in India," which has just been presented to Parliament, it appears that last year 21,682 fatal cases from attacks of wild animals had occurred in ten provinces, the largest number being in Bengal, namely, 10,062. The deaths from snake bites alone in the Punjaub last year were 828, against 979 in the preceding year. As showing the rapidly fatal effects from the bite of the cobra, the commonest and most deadly of Indian poisonous snakes, Surgeon A. J. Wall states that one night, about half past twelve o'clock, a Hindoo punkacooly, aged forty, while sleeping in the veranda of the doctor's house was bitten on the shoulder by a snake about three feet long. The noise and confusion soon awoke Mr. Wall, who at once hastened to the assistance of his servant, and after waiting for a short time for some ammonia, he proceeded to inject it, as recommended by Sir Joseph Fayrer and Professor Halford, previously giving the patient plenty of brandy, walking him rapidly about, etc.; yet, notwithstanding all attention, the man died in sixty-five minutes after the attack. Mr. Wall adds that the remedy had as little effect on the symptoms as it had on the result.

Rest for Headaches.

Dr. Day says, in a late lecture: Whatever be the plan of treatment decided upon, rest is the first principle to inculcate in every severe headache. Rest, which the busy man and the anxious mother cannot obtain so long as they can manage to keep about, is one of the first remedies for every headache, and we should never cease to enforce it. The brain, when excited, as much needs quiet and repose as a fractured limb or an inflamed eye, and it is obvious that the chances of shortening the seizure and arresting the pain will depend on our power to have this carried out effectually. It is a practical lesson to be kept steadily in view, in that there may lurk behind a simple headache some lesion of unknown magnitude which may remain stationary if quietude can be maintained.

There is a point worth attending to in the treatment of all headaches. See that the head is elevated at night, and the pillow hard; for, if it be soft, the head sinks into it and becomes hot, which with some people is enough to provoke an attack in the morning if sleep has been long and heavy.

Petroleum in Formosa.

Two Pennsylvania gentlemen have returned from China, whither they were about a year ago to examine, for the Chinese Government, the oil grounds of the Island of Formosa. They report that a well was drilled through soapstone 396 feet; then 136 feet of drill pipe were put in and 265 feet of casing. No more casing could be got in owing to the caving in of the rock. At 348 feet depth a large vein of salt water was struck, and it was found impossible to go more than 48 feet deeper. Fifty barrels of oil were pumped in ten days. The oil territory is unlike anything found in Pennsylvania. The oil is very light in color and gravity, and was burned in lamps without refining. The property belongs to the Chinese Government.

A New Mode of Locomotion.

The newspaper carrier who serves papers to the attendants in the Permanent Exhibition Building goes his rounds at the rate of 12 miles an hour. He travels on machines not unlike roller skates, which are called pedomotors, according to the inventor, Mr. J. H. Hobb, an architect on Walnut street, above Fifth. The day is not far distant, predicts the Philadelphia *Record*, when the whole city will be on wheels, when pedestrians will be skimming through the streets at the rate of 10 miles an hour, without more effort than is now put forth in perambulating half that distance.

The pedomotor consists of four tough, light, wooden wheels, supplied with an outer rim of tough India-rubber. These wheels are secured to a frame the shape of the foot, which is strapped to the pedal extremities in the usual manner. Unlike roller skates, the wheels of these little vehicles are not under, but are placed on each side of the foot, thus giving the wearer a good standing, as well as a solid footing. The rear wheels are 3 inches in diameter, while those in front are but 2½ inches. This gives the foot a slight incline, and when in motion has much to do in impelling the pedestrian forward. Extending from the toe, with a slight curl toward the ground, is a piece of casting termed the pusher, which is simply used in mounting an elevation or steep incline. From the center of the heel a small brass wheel extends backward, serving as a guide as well as a brake. The whole scarcely turns the scale at a pound weight. In using them no more effort is required than in ordinary walking. The wearer steps with his regular stride, and is amazed to find himself skimming over the ground so rapidly with so little muscular effort. Mr. Hobbs explains the mystery of the rapid movement in this manner: A man whose stride is 32 inches will traverse 48 inches, or one half further, with the pedomotor. This is because the body is in constant motion. For instance, says he, the traveler starts, and while he raises one foot to step, he continues rapidly onward until that foot is set down and the other raised to make another step. This gives him more momentum, and away he goes over the two miles in the same time to accomplish a mile with the feet. No effort of the body is required for their use, as in skates. The traveler simply puts one foot before the other, and finds himself whizzed along at a lively rate.

Horseshoes for Slippery Streets.

Why may we not adopt the means practiced in Germany of inserting temporary calks in horseshoes during the slippery season? The German smith, when finishing the shoe, punches a hole in the two ends, and when the shoe is cold he taps in a screw thread and screws into the shoe, when on the horse's foot, a sharp pointed stud of an inch in length; and with shoes thus fitted the horse can travel securely over the worst possible road, and I have never known one to slip either when riding or driving; and draught horses are shod in the same way. When the horse comes to stable the groom unscrews the pointed stud and screws in a button, so that no damage can happen to the horse, and the screw holes are prevented from filling. When the horse is going out the groom simply takes out the button and screws in the pointed stud, thus preventing strained sinews, and the public are spared the painful sight of horses down or slipping in all directions.

We believe that a patent was granted for substantially the above described German mode of attaching calks to horseshoes, but we have never known of its being adopted. Certainly if it is feasible to use such removable calks in Germany, and we are told they are in general use, then we know no reason why they are not equally adapted to our slippery streets.

A NOVEL BOOT AND SHOE HEEL.

The engraving shows, in perspective in Fig. 1 and in plan in Fig. 2, a spring boot heel recently patented by Mr. Edwin R. Pease, of Poughkeepsie, N. Y. This improvement is designed to furnish a certain amount of elasticity to the heel, so that walking may be made easier, and the heel will be more durable than heels of the ordinary kind.

In the heel is formed a cavity for receiving a spiral or rubber spring, and a stout leather plate or flap is secured to the narrower portion of the sole and extends backward over the spring. A metallic plate is fastened to the under surface of the leather flap, and rests upon a cross bar that projects a short distance from the sole. The leather flap is of sufficient thickness to prevent it from being pressed down into the spring or the cavity which contains it. The spring may be used or not, as may be desired.

PEASE'S SPRING BOOT HEEL.

AN IMPROVED LOCOMOTIVE SMOKE STACK.

The accompanying engraving illustrates an improved locomotive smoke stack, which may be readily adapted for either hard or soft coal, or for wood.

The smoke stack has a double conical lining, A, which contracts the exhaust steam and smoke at the lower part of the shaft of the stack, and thus allows a larger exhaust nozzle to be used with a much better effect on the fire, as the "blowing" property of the exhaust steam is thereby extended over a greater area of the flue sheet.

The lining is formed in a straight line from the contraction to the flaring top, leaving no projections upon which cinders, ashes, etc., can accumulate. The danger of the stack becoming rusted is thus avoided, and as the form of the lining is of the truss pattern, the stack is greatly strengthened.

The bonnet, B, and cone, C, are made removable, so that they may be replaced by those of a different form, to alter the stack from a wood to a hard or soft coal burner. When used as a soft coal burner, the form of cone and bonnet shown in Fig. 2 is used, and, in addition thereto, a perforated sleeve is inserted to occupy the space between the cone and bonnet. It is so arranged as to serve as a clamp to retain the bonnet.

When used as an anthracite coal burner, where no cone is required, a sheet metal sleeve, shown in Fig. 3, is inserted to occupy the space between the inside extension pipe, F, and the bonnet.

We are informed that these stacks have been introduced upon twenty-nine locomotives upon the St. Paul and Pacific Railroad, Minnesota, and are being placed upon all the locomotives of that road as rapidly as possible. The inventor states that they give very general satisfaction, and that a great saving of fuel is effected. Another advantage claimed for them is the avoidance of trailing smoke and sparks.

This smoke stack was patented November 19, 1878, by George W. Turner, Superintendent of Machinery, St. Paul and Pacific Railroad, St. Paul, Minnesota, from whom further information may be obtained.

Agricultural Education.

There is no nation in Europe so advanced in its methods of teaching agriculture as Italy, and in no nation is so much enthusiasm manifested and so much practical good accomplished. Italy possesses at the present time two higher schools of agriculture—one at Milan, and another at Portici; three special schools—a school of forestry at Vallambrosa, a school of horticulture at Naples, and a school of viticulture at Conegliano; two veterinary schools, at Milan and Naples; and twenty-one secondary schools, varying in importance and organization, but which may be compared broadly to the French agricultural colleges of Grignon and Montpellier. These establishments are largely subsidized, either by the state or by the province where they are situated. Thus, for instance, the province of Lecce pays $6,000 a year to its agricultural school, which numbers sixty-three students, of from eight to twenty-two years of age. The education which they receive is only elementary, and two-thirds of the pupils become gardeners when they leave the school. The rudiments of agriculture will soon be taught in every village school, without exception, and they have for some time formed part of the course of education in the normal schools, where young men are trained for the duties of teaching.

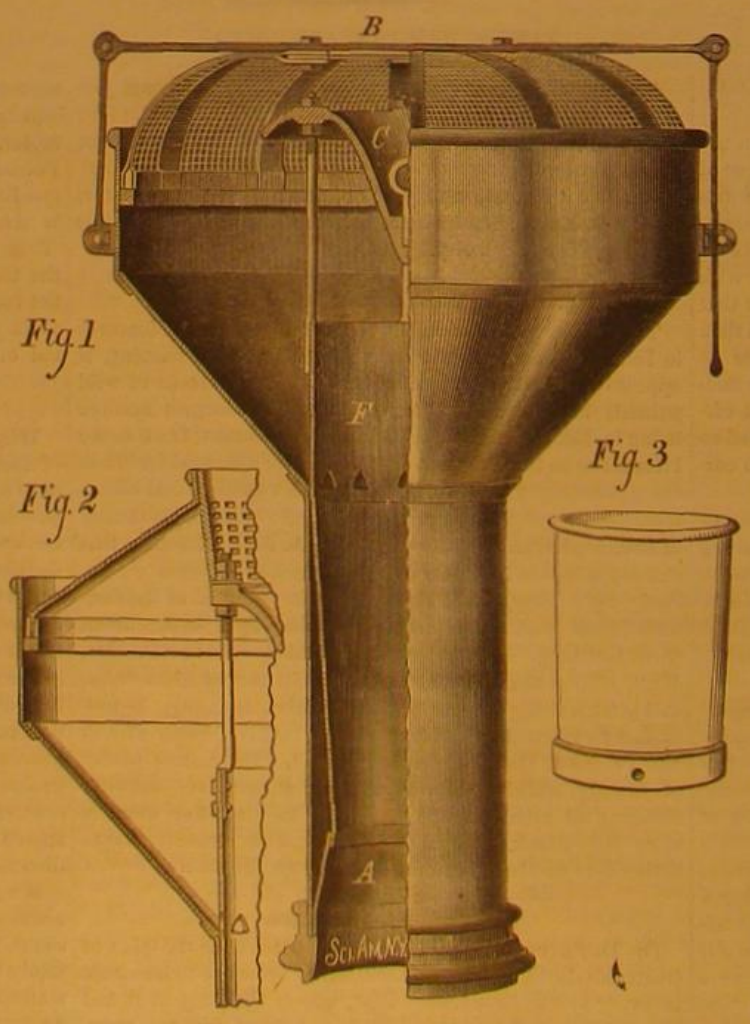
It has long been a matter of surprise to us, says the Boston *Journal of Chemistry*, that we have neglected to teach the principles of agriculture in our common schools. Almost everything else has been dabbled with—music, drawing, elocution, bookkeeping, etc.—but it has never occurred to the wise men who control our schools that a knowledge of husbandry is of more consequence to the welfare of our boys and our country than all these branches combined. The prosperity of a nation rests upon successful agriculture, and the happiness and well-being of thousands of the boys educated at the public expense rest upon knowing how to carry forward farm labors. A vast amount of information respecting how plants grow, how they feed, how to prepare the soil, and how to take care of stock and conduct dairy operations, might be imparted in our common schools. There are good text-books ready at hand, and if any more are wanted they can be prepared speedily.

In a large degree, the hope of educating a class of farmers who can avail themselves of much that science has accomplished for husbandry rests with our public schools, and it would indeed be mortifying to be found in the rear of Italy in this matter of agricultural education.

A CURIOUS INVENTION.

In a recent number of the *Journal of the Franklin Institute* is a description of a remarkable machine, designed and constructed last summer by a student at the University of Pennsylvania, Frank T. Freeland, class of 1879. It is called "an Automatic Tit-tat-to Machine," and with it any one can play that game, as if it were a person. It is a true automaton, that is, there is no one concealed in or around it who governs its move by electrical or any other means, as was the case with all the "automaton chess players." The principle upon which it works is this: There is in it a mechanical table of all the possible games, and two hands having nine fingers each. When the opponent makes a move the machine hunts with its left hand in the table for that move. Opposite it is set down the proper answering move. By pushing a lever the right hand discovers that move and transmits it to the board.

The machine was exhibited at the Franklin Institute. It is now at the University of Pennsylvania, where it has played a large number of games without losing a single one. The problem of designing a machine which would play one of the games of skill was never seriously attempted before but once, when the results arrived at were such as to present serious difficulties to the construction of the machine.

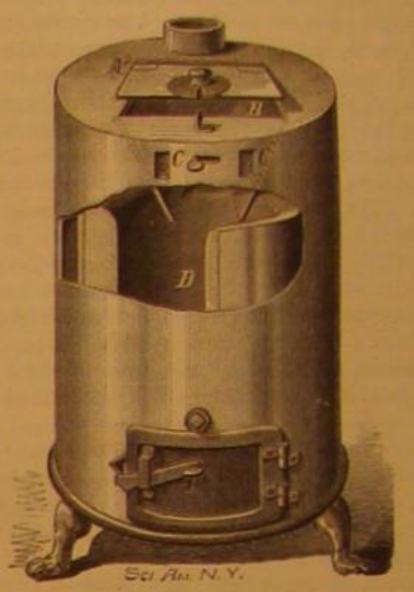


TURNER'S IMPROVED LOCOMOTIVE SMOKE STACK.

A NEW CAR STOVE.

We illustrate herewith a novel stove for heating cars which is designed to prevent the escape of fire in case of accident, and it is constructed with a view to durability.

The door, A, through which the fuel is introduced at the top of the stove, is provided with a fastener consisting of a notched disk which is engaged by a hook on the stove top. Below the door, A, there are two doors, B, which are kept open by their own weight, and will close automatically so as to prevent the escape of fire should the stove through accident become inverted. The draught holes which are covered by the damper, C, are provided with a perforated metal covering which prevents the escape of coals. The fire pot, D, is placed a few inches from the top of the stove, and below it there is an ash pit which is tightly closed by the door near the bottom of the stove.



RICE'S CAR STOVE.

The draught of the stove is downward through the coal; the products of combustion passing upward around the fire pot to the stove pipe seen at the top of the stove. By this arrangement, it is claimed, the grate is in the cooler part of the fire, and will, therefore, last longer than grates arranged in the usual way, and the hottest portion of the fire being uppermost, renders the stove effective.

For further particulars, address the inventor, Mr. Byron Rice, West Schuyler, N. Y.

New Mechanical Inventions.

Mr. Horace Chiazzari de Torres, of Turin, Italy, has devised an improved Automatic Feed Water Heater and Regulator, in which the exhaust steam is utilized for heating the feed water, effecting thereby a considerable saving in fuel and in the wear and tear of the boiler, as well as securing an increase of power by supplying feed water at a uniform temperature.

Mr. George W. Bennett, of Garden Prairie, Ill., has patented an improvement in Connecting the Knees of Sleighs with the beam on which the body is placed. It consists of a metal hub, provided with a groove which receives the beam, and an angular socket for receiving the upper end of the knee.

Mr. Burpee R. Starratt, of Truro, Nova Scotia, Canada, has patented an improved Railroad Frog, which is so constructed that the wing rails and the tongue, when broken or worn, can be removed and replaced with new ones without removing the frog from its bed.

An improvement in Portable Ladder Steps has been patented by Mr. Salvador Ellicott, of Steilacoom, Washington Territory. The object of this invention is to furnish an improved step for ladders which may be easily and conveniently applied to an ordinary ladder and moved up and down upon it.

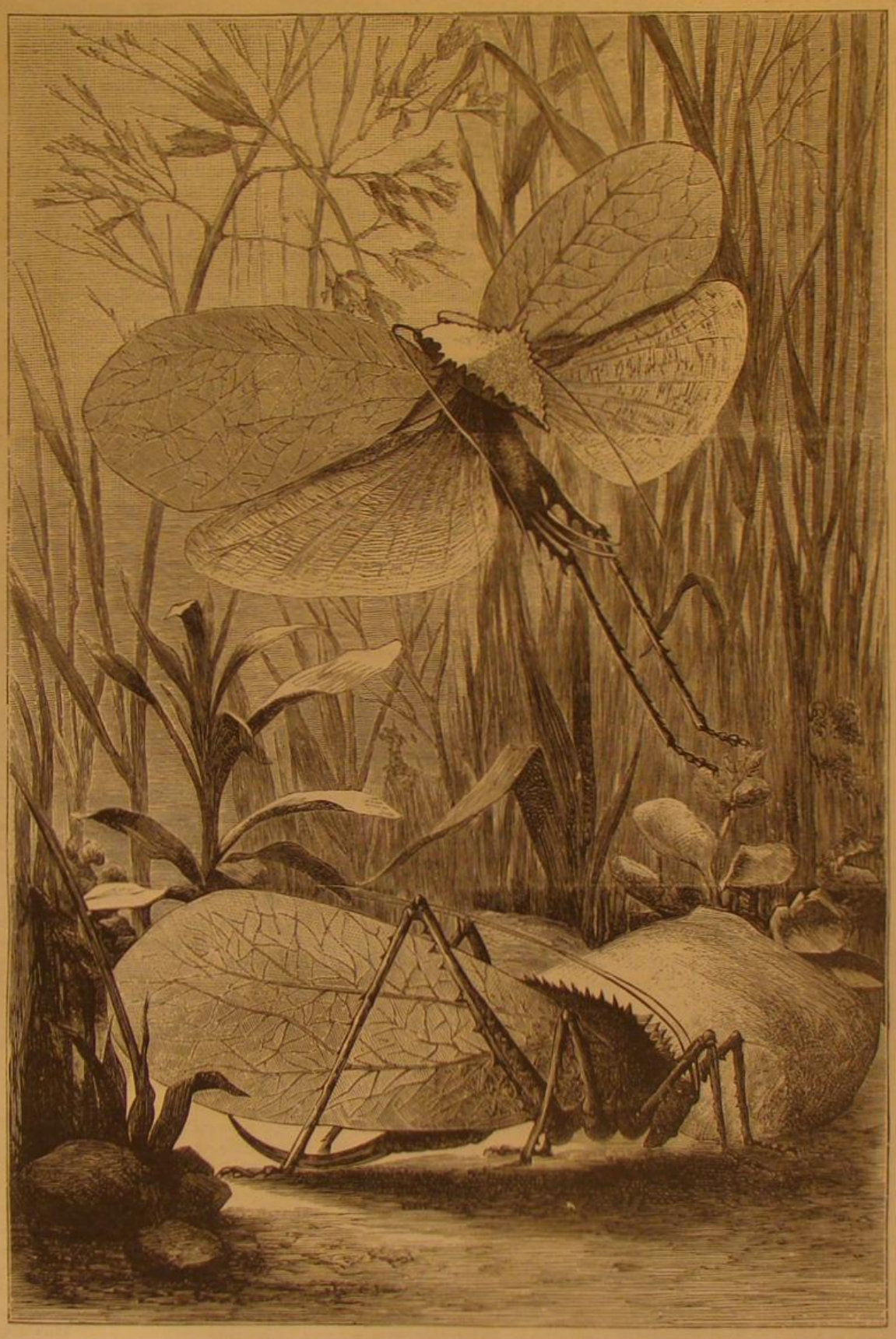
The Separation of Silver from Lead.

The separation of silver from lead has been effected by hand labor; but is now substituted, says *Chambers' Journal*, by applying steam "as an agitator in the pot where the crystallization of the pure lead takes place, and in other respects it produces a chemical change, and facilitates the work." Another process separates the silver "by means of zinc, which is found to wash the melted lead entirely free of the silver contained in it, and the mixture of silver and zinc floats to the top of the pot and is skimmed off. When this is completed, the mixture of zinc and silver is placed in plumbago crucibles in a furnace, and the zinc is distilled off and collected in small metal chambers, where it cools in the form of cake zinc, and is fit for use again." By this means about half of the original zinc is saved, and it is thought that the other half may be recoverable.

THE GREAT SHIELDED LOCUST OF PAPUA.

The insects of Papua, or New Guinea, as that vast island is commonly called on English maps, are comparatively little known; yet they appear to rival in strangeness and beauty of form and brilliancy of color the better known birds of that tropical region, typical examples of which are seen in the birds of Paradise. Here the magnificent green and yellow ornithoptera, or bird-winged butterflies, find their richest development. Wallace calls them the princes of the butterfly tribes; and they are as remarkable for their great size as for their singular markings and magnificent coloration. Here, too, are found the largest and most beautiful of the clear-winged moths, and their handsome rivals among the green moths. Many species of beetles of large size and the most brilliant metallic luster also abound, almost all of the orders furnishing large or extraordinary forms. The same is true of the locust or grasshopper tribes. The most remarkable of those thus far discovered is the *Megalodon ensifer*, or great shielded grasshopper, figured in our engraving, which we copy from *La Nature*. The glossy green wing-coverts when fully expanded are from 9 to 10 inches across, and beautifully veined in imitation of large shining tropical leaves. The thorax is covered by a triangular horny shield, 2½ inches long, with serrated edges, a wavy hollow surface and a faint median line, the whole closely resembling a leaf. The body is short, and, in the female, is terminated by a long, curved, sword-like ovipositor. The legs are long and strongly spined.

These insects are sluggish in their motions, depending for safety on their mimickry of foliage, their horny shield and wing coverts, and their spiny legs.



THE GREAT SHIELDED LOCUST OF PAPUA.

Natural History Notes.

Prolonged Torpidity of Toads.—Professor J. A. Allen, of Cambridge, states that he saw a large number of toads taken from the mud of a well which had been closed for twenty years. The animals were apparently lifeless, being quite motionless, but after being drawn up and exposed to the air their legs began to twitch after a few moments, and their eyes slowly to open and close. In three or four minutes they so far recovered as to hop about, and shortly after became as bright if they had not been sound asleep for the last score of years. The temperature of the mud in which they were found was about 45 degrees, which was no doubt maintained throughout the year; and, as this corresponds very nearly to that of ponds where they hibernate in winter, Professor Allen thinks that this prolonged torpidity was caused by a continued uniformity of temperature, and that he sees no reason why it should not have been protracted indefinitely.

The Fruit of the Fig Tree.—The fruit of the fig tree, or what we call the "fig," is very singular. In its earliest stage it is not unlike some other fruits, but during the course of its development it undergoes a strange modification. In its incipient state it is an aggregation of numberless flower buds, which in ordinary course would be developed on a long branch; but in the case of the fig the branch, instead of developing into a woody limb bearing flowers, grows up around the multitude of flowers, inclosing them in a pyriform receptacle, and forming a succulent fruit, inside of a woody branch. The fig that we eat, then, is not a fruit at all, properly so called, but a succulent branch. The real fruits are what are usually taken for seeds, and each of which was the product of a separate regular flower. This kind of fructification was called by the botanist, Mirbel, a *syconus*, which signifies in Greek "a fig garden."

Snakes and Cold Victuals.—The notion is a popular one that snakes never eat what has not been killed by their own agency; and, although such a belief is now known to be false by naturalists, yet very few of the one hundred and thirty two species of North American serpents have been proved, by actual observation, to have eaten any animal which they have not captured alive. A writer in the *American Naturalist* communicates the following notes on the feeding habits of the common black snake (*Bascanion constrictor*), a species which has not hitherto been credited with a fondness for cold victuals. The writer states that last June he killed a garter snake, and happening to pass the place the next day, he came upon a black snake with about an inch of the tail of a garter snake protruding from its mouth. As the snake killed on the previous day was nowhere to be seen, he suspected the one inside the black snake to be the same. On removing the garter snake this proved to be the fact, as was evinced by the wounds he had made on the animal's head and body. The length of the black snake was a little less than three and a half feet, and that of his dinner twenty-two inches.

Do Leaves Absorb Water?—The question whether the green parts of plants can or do absorb moisture by their surfaces, as rain and condensed dew and mist, or even watery vapor, has been a subject of controversy for the last one hundred and fifty years; but, it is to be hoped, it is now set at rest forever by the recent investigations of the Rev. Geo. Henslow. The earlier experimenters on this subject—Hales (1731) and Bonnet (1753)—were persuaded that leaves absorb dew and rain. For over a century the investigations of others supported this same view, until, in 1857, M. Duchartre, from his experiments, advanced a contrary opinion, and the one which is now held by most vegetable physiologists, and commonly taught in our schools. But, strange to say, gardeners in their every-day operations adopt a different notion from that prevailing in science.

Mr. Henslow, in his paper read before the Linnæan Society, shows that while it may be true that, as Duchartre has said, dew is not absorbed by saturated tissues at night, yet, on the contrary, his (Henslow's) experiments go to prove that absorption does take place at and after sunrise, when transpiration recommences, and an indraught is caused by the moisture, wherever lingering on the leaves. He further corroborates M. Boussingault's late assertion that when leaves are purposely or naturally killed by excessive drought, they then do absorb water, as proved by the balance or otherwise.

The Botrychia and Ophioglossa not Ferns.—In nearly all manuals of botany the species of *Botrychium* ("Flowering Ferns") and *Ophioglossum* ("Adder's Tongue") are included among the ferns, arranged as a sub-order under the name of *Ophioglossaceæ*. Mr. John Robinson, in the *Science News*, proposes the removal of these genera from the ferns, to constitute a separate order of equivalent value with the latter. The grounds upon which he urges this are: (1) That in the primary development of their fronds the *Ophioglossaceæ* are straight, and not rolled up, or "circinate," as the ferns are; and if the base of the plants be examined with the microscope the buds for several succeeding years will be found one below another, still in an erect position, the rudimentary sterile and fertile fronds in the most highly developed buds clasping each other; (2) the growth of the prothallus takes place under ground, is very small, has but few root hairs, and is destitute of chlorophyl; while in the true ferns the prothallus is from three to four times larger, has a profusion of root hairs, contains much chlorophyl, and is developed above ground; (3) the spores of ferns are in cases developed from the outer layer of the cells of the frond, while the spores of the *Ophioglossaceæ* are derived from the inner tissue of the fertile spike or frond which bears them, and this more strongly resembles the production of pollen in the anthers of flowering plants. Mr. Robinson in a systematic arrangement would place his proposed new order in advance of both the ferns and equisetums. He adds, in conclusion, that the *Ophioglossaceæ* differ more from the ferns than do the equisetums, and as much as most lycopods, and that this fact should be more generally known to collectors.

Termites kept in Captivity by Ants.—Mr. H. O. Forbes states, in *Nature*, that while entomologizing in Portugal in 1877, in the vicinity of Cintra, he found the nest of the black ant (*Formica nigra*) under a stone. On turning it over there was, as usual, great consternation in the community, and he discovered that it was evidently caused by the fear least a colony of *Termes lucifugus* (which the formicas had enslaved) should escape. The "nigras" instantly began seizing the termites, driving them underground by the nearest orifices, in the meantime wrenching and pulling off their wings in the most unceremonious manner. In the nest there was also a great number of termite larvæ. The great object of the owners of the "location" seemed to be to get these larvæ underground as speedily as possible. The ants fell on them with great impetuosity, seizing them and dragging them, against the most strenuous opposition, into the nearest apertures of the underground home. Very often this opposition resulted in a long and stern fight, in which the larvæ were often badly wounded, being sometimes deprived of their antennæ, sometimes of half their jaws, and not seldom killed outright. Occasionally, however, the larvæ were victorious, in which case they did not make off, but remained perambulating the nest. The author saw one larva, at the end of a long fight, drawn by one of its antennæ, while it firmly held fast to a small ball of earth which had proved a vain anchorage for its feet, for larva and clod together were drawn across the top of the nest 5 or 6 inches, up the side 1½ inch, and away among the grass, where, losing the ball of earth, it seized a stalk so firmly that its abductor could not drag it further, whereupon, after reconnoitering the ground for a short distance, the latter disappeared, but returned shortly with a companion, with whose aid the larva was detached. This done, the helper returned home, while the abductor proceeded with his prisoner till lost to view in the grass, some 12 or 14 inches from where it originally started.

Fresh Water Muscles and Ducks.—Mr. Fred. Mather, in the *American Naturalist*, notes the curious fact that at a point

near White House Landing, Virginia, on the Pamunky river, where muscles (*Unios*) abound, it has been found impossible to raise ducks, for the reason that at low water the ducklings were liable to be caught by the muscles and held until drowned by the rising tide. M. Mather adds that this information, which was given him by a gentleman residing there, was afterwards confirmed by the Pamunky Indians, who live on an island below White House, and who, with every facility for raising large numbers of ducks, do not keep them.

The International Fishery Exhibition.

The prospectus of the International Fishery Exhibition, to be held at Berlin, in April, 1880, under the patronage of the Crown Prince of Germany, covers the following:

CLASS I.—AQUATIC ANIMALS.

1. Alive or stuffed, preserved in alcohol, or represented in pictures, casts, etc.

2. Prepared or dried, salted, smoked, pulverized, preserved in tins, etc.; the various stages of preparation to be shown.

In particular the following are desired: A. Sponges, in their natural state and prepared for use, shown according to their various species and localities. B. Corals, in their natural state and prepared for use. C. Mollusca; oysters, samples of shells from the most famous localities, anatomy of the oyster in enlarged proportions; shells of all sorts, pearl shells, mother of pearl, manufactured; pearls, sorted according to their value; imitation of pearl, river pearl shells; mother of pearl, from the same. D. Star fish, stella marina, sea urchins. E. Worms. F. Insects (chrysalides of insects, as destroyers of spawn, or as food for fish). G. Crustacea; various species of crawfish. H. Fish of all kinds and of all zones I. Amphibious animals, tortoises, turtles, terrapins, etc ; tortoise shells in different stages of preparation up to the comb or boule furniture (for comparison's sake, also counterfeit tortoise shell); salamanders, frogs (spawn of frogs), snakes (skins of snakes). K. Aquatic birds (all sorts of birds detrimental to fishing, sea gulls, herons, cormorants, etc.) L. Mammalia (seals, whales), and manufactured articles from the same; mammalia detrimental to fresh water fish.

3. All kinds of products manufactured from aquatic animals.

CLASS II.—FISHING.

A. Fishing gear of every kind and from every country, or models thereof. B. Fishing craft of all nations, in models and representations. C. Fishing tackle and netting in different stages of preparation. D. Machinery and implements used for working up the raw material.

CLASS III.—PISCICULTURE.

A. Hatching apparatus in operation. All kinds of appliances and implements for the artificial breeding of fish, crabs, and shells. Boxes for conveyance of fry, etc. B. Models or drawings of appliances for protecting or perfecting aquatic animals (salmon ladders, etc.). D. Aquaria of all sorts. E. Illustrations of the development of some of the most important species, such as oysters, salmon, herring, crawfish, etc., shown in their various periods of growth.

CLASS IV.

Appliances in use for keeping and conveying freshly caught aquatic animals; also working models for such appliances. Conveyance of freshly caught fish by railway.

CLASS V.

Models and other representations of appliances in use for the preparation and preservation, by drying, salting, smoking, etc., of the produce of fisheries for commercial purposes (smoking houses, etc.), and for household purposes (fish kettles, fish dishes, etc.).

CLASS VI.

Models of fishermen's dwellings and costumes; also of fishing implements, not included in the foregoing classes.

CLASS VII.—SCIENTIFIC INVESTIGATIONS REGARDING THE STOCK OF FISH.

Physico-chemical researches; investigation of the bottom of the sea and lakes, shown by samples; aquatic plants in relation to fishing, herbaria, etc.; researches into aquatic fauna (animals of the subordinate classes preserved in alcohol, or prepared, etc.); apparatus and implements used in such researches.

CLASS VIII.—HISTORY OF FISHING.

Implements of fishing, original or in reproduction from the oldest times downward; also models, pictures, seals, emblems of ancient fishermen's guilds, etc.

CLASS IX.

Literature, statistics of fishery, maps showing the geographical distribution of fish.

CONDITIONS OF THE EXHIBITION.

1. Persons willing to exhibit should apply by letter, before January 1, 1880, to the committee of the German Fishery Society, which will decide on the admission of the objects announced for exhibition. The application should state the class, according to the above prospectus, and the amount and description of space required (whether on walls, floors, or table).

2. The committee of the German Fishery Society will defray all expenses connected with the general management and the internal arrangement of the Exhibition.

3. Objects accepted for exhibition should be sent to Berlin, free of charge, during the month of March, the committee undertaking the expense of carriage from the Berlin Railway termini to the building of the Exhibition. The exact date and address will be communicated later. Perishable objects will be accepted during the course of the Exhibition only.

4. The committee will watch over the safety of all objects, without, however, holding itself responsible for losses or injuries by accident or robbery or fire, etc. On application the committee will cause objects to be insured against fire at its own expense.

5. After the close of the Exhibition all objects will be returned to the exhibitors free of charge, the committee defraying all expenses, with the exception of perishable articles, which will be disposed of at Berlin in accordance with such understanding as the committee may enter into with the exhibitor.

6. The public will be informed in a later communication whether an abatement of freights has been obtained, and whether prizes will be awarded.

7. All objects should, so far as possible, be marked with the exhibitor's name and direction. In cases where it is desired that they should be returned at the close of the Exhibition, an exact list must be forwarded to the committee.

Trademarks.

The law of trademarks is an outgrowth of the ancient law-merchant, which Lord Mansfield mentions as being a branch of public law which does not "rest essentially for its character and authority on the positive institutions and local customs of any particular country, but consists of certain principles of equity and usages of trade, which general convenience and a common sense of justice had established to regulate the dealings of merchants in all commercial countries of the civilized world." While a patent for an invention is a grant, a trademark is merely an arbitrary symbol—not necessarily new in its design—adopted by its user to be affixed to the merchandise which he manufactures or sells, for the purpose of indicating its origin or ownership.

Since the enactment of the registration act of 1870 there have been registered at the Patent Office 6,800 trademarks—for which the government has received fees amounting to $170,000—836 of which were registered within the first six months of the year 1878. The value of a national trademark law is universally conceded. It accomplishes that which cannot possibly be effected by mere State legislation; for besides furnishing a single repository for these valuable aids in carrying on commerce, where all may go for reliable information concerning their history, it provides record evidence of title of a high character, as well as speedy and effectual means for vindicating a well founded title of this nature at any point within the territorial limits of the country. The importance of extending national protection, by legislative enactment, over this class of property has been recognized by many if not all of the commercial powers, and the trademark legislation in this country has done much to encourage manufactures among its citizens as well as importations into the country by foreigners. Treaties relating to this subject have been negotiated with Russia, Belgium, France, the German Empire, Austria, and Great Britain.

In view of the opposing decisions in the several districts, it is plain that until the disputed question shall have been judicially determined by the court of last resort, the federal officers, administrative as well as judicial—excepting those within the sixth circuit—must continue to execute the law as if its constitutionality had not been brought in question.

It has been shown that Congress did not create, or intend to create, any right of property in trademarks, it simply proposing, by its legislation, to regulate an existing right already guaranteed protection by the common law. If the legislation is a regulation of commerce it is authorized by the organic law, which confers upon Congress the power to "make all laws which shall be necessary and proper for carrying into execution" the power to regulate that subject. If it can be established that the protection of trademarks is a regulation of commerce, the legislation of Congress upon the subject can be fairly placed upon the commerce clause of the Constitution, which recites that "Congress shall have power to regulate commerce with the foreign nations and among the several States and with the Indian tribes."

"Commerce," as defined by Bouvier (Law Dictionary), is "the various agreements which have for their objects facilitating the exchange of the products of the earth, or the industry of man, with an intent to realize a profit." Burrill defines the term: "Commerce, in a strict sense, is traffic in merchandise; in a general sense, the interchange of goods, wares, etc." The trademark placed by the manufacturer upon his wares, in addition to its indicating to the purchaser the origin of the goods, is a guarantee of the excellence of the same, serving as a safeguard to the purchaser against the imposition of unprincipled manufacturers, and as a protection to the superior skill and industry of the owner of the same. Thus the trademark, which has been not inaptly called "a trader's commercial signature," facilitates the "buying and selling, and exchanging of commodities," which, as declared by the Supreme Court of the United States, "is the essence of all commerce."

It may be safely assumed that trademarks are as clearly an incident of commerce as navigation itself, and hence a proper subject for legislative regulation. The regulation of the subject by Congress is in its entire extent within the organic act. That it is so, as regards its operation upon foreigners, and as it affects the interests of citizens of different States, would seem to be so plain as to admit of no possible contradiction. —*Albany Law Journal.*

American Trade with Japan.

Our Minister to Japan, Mr. John A. Bingham, naturally takes a deep interest in the development of American trade with that empire. In a recent interview he said:

"The United States are ten days nearer Yokohama than any other country. We manufacture everything that the Japanese want, and if Congress gives us proper legislation there is no reason in the world why we should not command nine tenths of the trade with China and Japan. The finest silk in the world is grown in Japan, and their teas are used in nearly every household in America. There are very few power looms in Japan. The silk is nearly all manufactured by hand, and the advent of American machinery there would completely revolutionize the silk trade. Let Congress give us the ships, and the raw material can be brought from Japan and be manufactured in the United States at prices which would defy the competition of European silk manufacturers. I am no longer a national legislator and have no right to speak as one, but I believe it to be the duty of every member of Congress to do all in his power to promote commerce. Commerce is the right hand of civilization. Every legitimate means should be employed to build it up. There appears to be great opposition in this country to everything that looks like what is called 'a subsidy.' Look at England. She rules the commerce of the world, and she is contantly subsidizing every line of vessels that will develop trade between England and any foreign country. It would be idle to say that Congress is not aware of the commercial needs of America, and I suppose that in time the legislation will be given us that we need; but the sooner that legislation comes the more rapid will be our commercial growth and greatness."

America is becoming day by day a more important factor in the world's progress. It is to-day the richest country on the globe; but, said Mr. Bingham, with all our great possessions we cannot hope to become the leader of nations until we have commerce.

An American Industry in China.

A Shanghai paper describes a recently established industry in that city. The object is to preserve eggs in such a manner that they will be fresh and suitable for consumption, or more particularly, useful in cooking, for any length of time and in every climate. The eggs are procured by regular egg dealers from the farmers around, and are bought by the company on very favorable terms, sometimes dearer and sometimes cheaper; but always at a far lower rate than they would be procurable elsewhere. The quantity preserved daily depends more on supply than anything else. As many as 500 dozen a day can be done, if they are forthcoming. Nothing can be more simple than the process. The eggs are broken, and white and yolk together are emptied into a vast flat trough lined with lead, which looks like a gigantic billiard table. The trough is only a few inches deep; but underneath it steam is admitted by pipes from a large boiler, by means of which the eggs are desiccated until they assume the appearance of a kind of egg paste. There is a small quantity of sugar and salt mixed with it, and then it is drawn off and packed in tins, which are finally hermetically sealed. The business is entirely export, and almost exclusively to England, a small proportion going to San Francisco. The process is an American invention, and the company employing it carry on the business extensively in this country also.

Progress of the American Paper Trade.

In 1869 the United States exported $3,777 worth of paper and stationery. Five years later the exports had risen to the value of $662,332. The same year, 1873, our imports of paper and stationery amounted to $1,326,460. Since then the imports have steadily declined and the exports have risen, so that last year the imports amounted to only $135,487, while the exports rose to $1,108,318. In view of these facts a contemporary sensibly remarks that the American people may well be proud of the wonderful success of its paper manufacturers. It has been accomplished only by the most determined efforts, the greatest enterprise, and the utmost sagacity. With the start thus obtained, with their abundance of material, with mills fitted up with the most improved machinery, and with skilled workmen, there is no reason why they should not soon control the paper market of the world.

Howe's Scales Abroad.

The result of advertising in newspapers circulating largely abroad is felt by many of our enterprising manufacturers. Among those who appreciate the advantages of seeking a foreign market when business is dull at home, is the Howe Scale Company, who have recently shipped one of their 10-ton stock scales, with a platform 22 feet long, for use in the Liverpool stock yards. They have also shipped to Paris 100 scales for use in that market; and they are setting some of their largest scales at the Hague.

The Treatment of Sprains.

Mr. Dacre Fox, an English surgeon to a large railway company, who has had considerable experience of this form of injury, says that in the more severe cases he finds that after a few days of fomentation the best treatment is regulated pressure by means of carefully adjusted pads and large plasters of a special shape, varying according to the particular joint involved. By this plan he feels sure that it is possible to control the effusions into the sheaths of the tendons and adjacent structures, to lessen the pain, and to shorten the duration of treatment.

IMPROVED POWER FEED SANDPAPERING MACHINE.

It is now common to finish irregular objects, such as wheels, parts of carriages, and the stocks of firearms, by machinery, so that they compare favorably with similar work done by skilled operators; and, in many cases, the machine work is really more excellent. The production of plane wooden surfaces is not so easily accomplished by machinery, and it is one of the things which has not been done until quite recently; one reason for this is that little skill is required and the labor is inexpensive; but when a business of a certain character grows, so that a great number of workmen are required to perform a particular branch of labor, there arises a demand for labor-saving machinery.

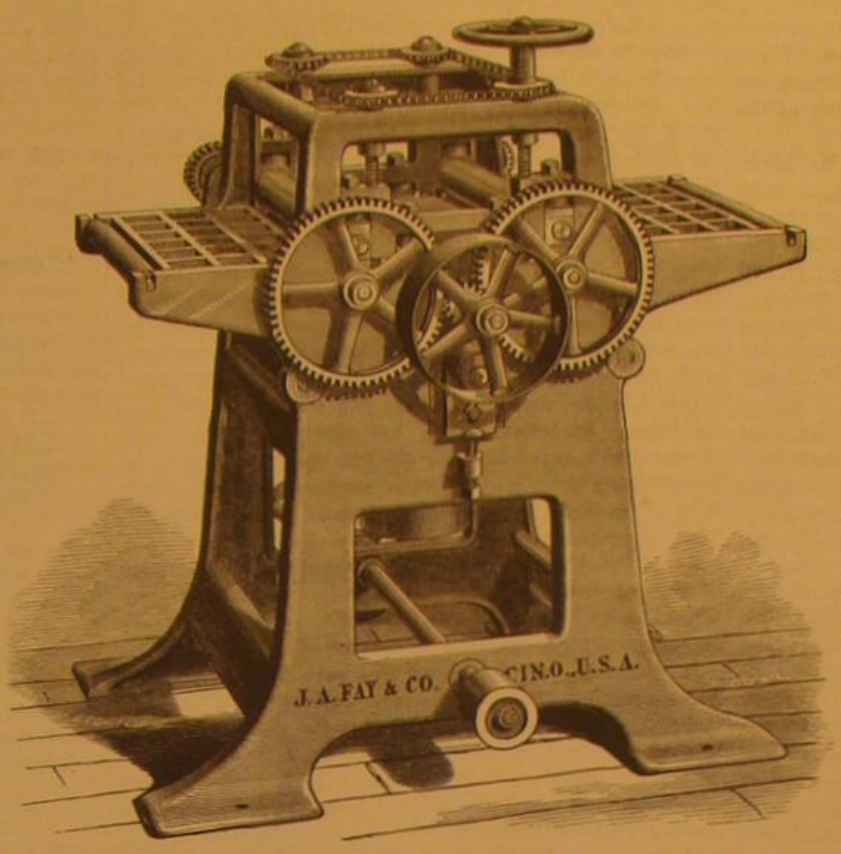
Several methods of smoothing plane woodwork with sandpaper have been tried. Some of them are adapted to special purposes and answer well for preparing surfaces for receiving paint, but where greater perfection is essential, as in the case of pianos and some classes of furniture, something better is required.

The cylinder sandpapering machines, with or without power-feeding apparatus, seem to be adapted to fine work, and are coming into use, performing excellent service when properly constructed.

We present to our readers an engraving of a power feed sandpapering machine for producing perfectly smoothed surfaces, constructed by the eminent woodworking machinery manufacturers, Messrs. J. A. Fay & Co., Cincinnati, Ohio. This machine has some peculiarities in its construction worthy of notice as tending to insure convenience in operation and perfection of product. The feeding arrangement is geared to drive from the cylinder shaft, and consists of four driven rollers, two in the table, and two supported to be raised and lowered by screws operated simultaneously by one hand-wheel. The lower and upper rollers are connected by expansion gearing to graduate for different thicknesses of stuff, one pair of rollers being on either side of the cylinder, and the upper roller having springs to give the required pressure on the material being fed through. The lumber is passed between the rollers. The sandpapering cylinder projects through the table sufficiently to give the required cut. The cylinder is adjustable vertically for more or less cut, as may be desired, and is covered by an elastic substance which gives its surface a peculiar flexibility, and keeps a comparatively large surface of sandpaper constantly in contact with the material being smoothed. This flexibility of the cylinder, in combination with the vibratory motion endwise, are elements peculiar to this machine, and seem indispensable for the work to be accomplished. All parts of the machine are easy of access, the entire feed works being hinged to the column, so that the cylinder can be reached without difficulty. As the cylinder is inclosed in a case, the dust can be conveyed by an exhaust pipe to any desired point.

In furniture, cabinet, coffin, and piano making, as well as many other branches of woodworking, this machine will prove of great utility. It is stated that one machine will do better and more perfect work than can possibly be accomplished in the old way by hand, and will save the labor of twenty men.

Further particulars may be obtained by addressing the patentees and manufacturers.



J. A. FAY & CO.'S POWER FEED SANDPAPERING MACHINE.

New Inventions.

Mr. Conrad H. Matthiessen, of Odell, Ill., has patented a Wagon Track, each rail of which is formed of three perpendicular wooden pieces, the intermediate one being sunk below the other two.

Mr. Michael E. Toomey, of Rathbone Place, England, has devised an improved Dental Tray to be used in taking wax or other impressions of the teeth, gums, and palate for dental purposes. It consists in a tray so constructed as to enable a complete impression of the mouth—that is to say, of the upper and lower jaws, the palate, and also of the "bite"—to be obtained at one operation and by the patient himself.

Mr. Ambrose P. Miller, of Hoboken, N. J., has patented an improved Handle Socket for picks, cold chisels, tamping bars, adzes, and other tools, which is so constructed as to enable the tools to be made easier and cheaper than in the usual way.

An improvement in Brushes has been patented by Mr. Frederick Sprower, of Brooklyn (E. D.), N. Y. The object of this invention is to secure the ends of the bristles, so that when the brush is bent or the point is struck against an object they will be held in place and prevented from slipping up and becoming loosened on the handle.

Mr. Charles O. G. Kennel, of New York city, has patented a Chimney Cowl or Ventilator designed to deflect the natural currents of air so that a draught in the chimney or ventilating shaft is continually maintained; also, to protect the chimney or ventilating shaft from downward currents and from rain or snow.

Teredo-Proof Trees.

Dr. Kellogg, in the Proceedings of the California Academy of Sciences, states that there are but two trees known to him which are perfectly proof against the teredo, or pile borer (*Teredo navalis*) of tidal water. These are the palettmo and the Australian *Eucalyptus rostrata*. The teredo will attack the wood of *Eucalyptus globulus*, as well as other species.

Archæology.

From our late foreign exchanges we learn that renewed interest is awakened in the East for prosecuting excavations in various parts for archæological treasures. Favored by the authorities at Constantinople, Dr. Schliemann is again busily excavating at Troy; and Mr. Rassam has permission to dig anywhere in Mesopotamia. With such a comprehensive grant, districts will be opened that have not hitherto been searched, and we shall hear of fresh discoveries at Nineveh, of explorations in the long hidden ancient city of Assur, and of endeavors to find the famous royal "record office," or "Babylonian Bank," as some Assyriologists call it, in which were stored a large collection of mercantile tablets, representing the monetary transactions of a firm trading in the name of Egibi & Sons. It is curious to have bills for corn and fruits, and woven goods, and invoices and vouchers from the days of Nabupalassar and Artaxerxes in the form of baked clay; but they are to be seen at the British Museum. The Arabs and Jews from whom they were obtained have kept the secret so well that the place in which they were discovered is not yet known to Europeans.

Kutha, now a group of great mounds, was the sacred university city of Babylonia, and had an extensive library, which is frequently referred to in mythological tablets discovered in other parts of the kingdom. It was from that storehouse of learning that the tablets giving an account of the creation were originally taken; and it is hoped that discoveries of other documents not less interesting will there be made.

In the mound of Nebbi-Yunus, search will be made for the palace of Sennacherib, in the expectation that some records of the latter years of that monarch may be found, "and possibly some accounts, however meager, of the second campaign against Hezekiah."

But besides all this, Mr. Rassam will make explorations in the country of that ancient people, often mentioned in Scripture—the Hittites. The existence of mounds along the bank of the Euphrates has long been known; and under a certain group known as the mounds of Jerabolus, it is supposed that Carchemish, the Hittite capital, lies hidden. Inscriptions in an unknown character were found in that neighborhood a few years ago; and it is hoped that some key thereto may be met with in the course of the excavations now to be undertaken, and furnish to scholars the link wanting to connect Assyria with Western Asia. As the firman granted to Mr. Rassam extends over a number of years, we may trust that the interesting enterprise will be carried to a successful issue.

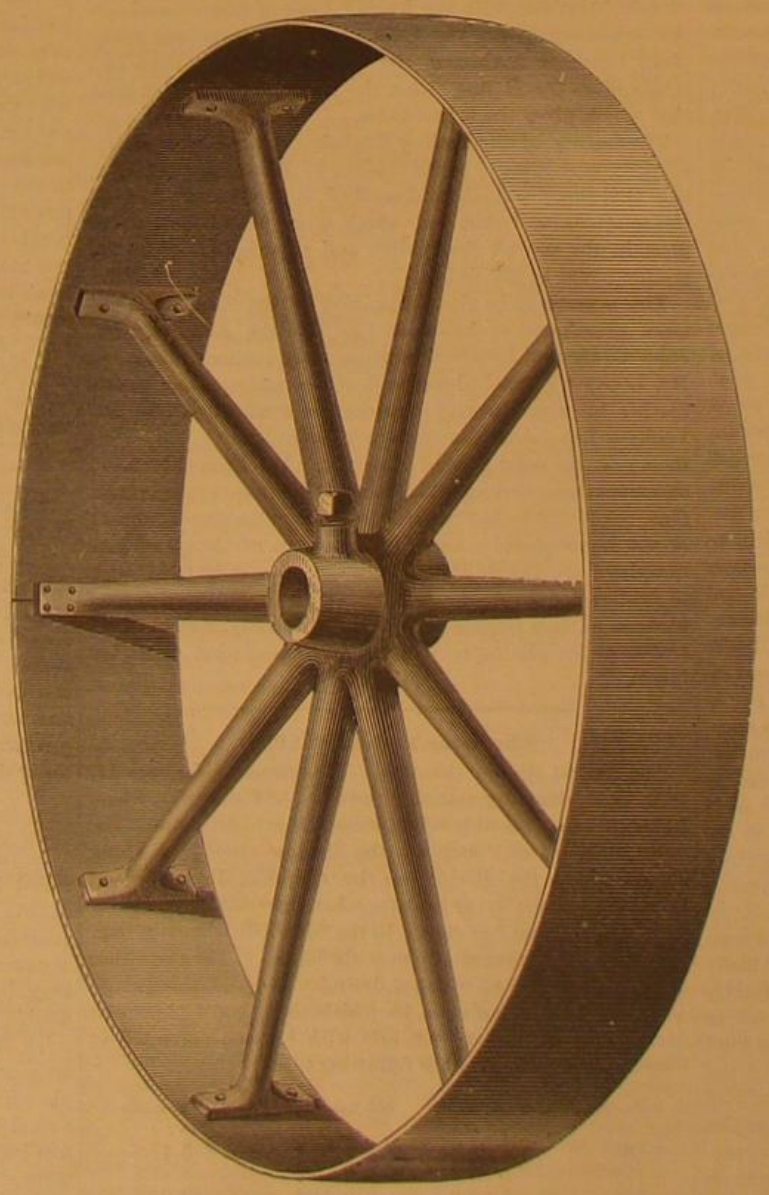
HARD ROLLED IRON AND STEEL RIM PULLEYS.

In every branch of constructive art, from the simplest implement to the most powerful and complicated engine, American workmanship is specially characterized by a skillful adaptation of material, in kind, quality, and weight, to the duty it is to perform. The aim is to employ, in every part of every implement or machine, just so much material of the most suitable sort as may be needed, and not an ounce more. Thus intelligent design is visible in every part of every truly American product, and, as a rule, the lightness of American machinery is not less noticeable than its strength and durability. This appears in the accessory parts as well as in the more essential; and very frequently the lightening of the accessories makes possible a corresponding reduction in the weight of the parts which have the main portion of the work to do.

An illustration of this tendency of American workmanship, and the advantages of it, is seen in the recently patented pulley shown in the engraving. By its structure and the allotment of its material, this pulley is designed to give the greatest strength with the least weight consistent with the duty which a pulley has to perform. Its advantages over any cast pulley are found in its superior strength, due to the absence of shrinkage strains in the arms; to its more perfect balancing, the metal in the rim being uniform in section, and every part equidistant from the center; to the fibrous character of the steel rim, the fibers running in the direction of the strains; also to its diminished weight, allowing it to be safely run at much higher speeds than the common cast iron pulley, and on lighter castings, with a greatly diminished weight of metal in hangers, framings, and so on.

The weights of these pulleys range as follows: 48x9 inches, 110 lbs.; 36x8 inches, 75 lbs.; 36x6 inches, 62 lbs.; 24x6 inches, 36 lbs.; 18x4½ inches, 20 lbs.; 15x4½ inches, 17 lbs.; 12x4 inches, 10 lbs.; 9x2½ inches, 4 lbs.

For driving cotton and woolen machinery, blowers, and in the construction of milling and agricultural machines, this combination of strength with lightness is a manifest advantage. Economy in freightage, when shipped to a distance, is another item worth noticing. These pulleys can be made in any good establishment at a cost, the patentee claims, not exceeding half that of an all cast pulley. The patent is for sale. For particulars inquire of Geo. W. Fisher, Superintendent Fulton Iron Works, St. Louis, Mo., or of Philip Medart, 107 Market street, the same city.



HARD ROLLED IRON AND STEEL RIM PULLEYS.

Mr. Lockyer's Solar Studies.

The popular enthusiasm awakened by the first revelations of the spectroscope promises to be surpassed by the interest resulting from its latest teachings. Whether Mr. Lockyer's solar hypotheses are verifiable or not by existing facts or future observations, the boldness of his assertions, and the evident sincerity of his convictions with regard to the correctness of his interpretation of solar phenomena, cannot fail to challenge the attention of spectroscopists and chemists as well as the imagination of the public at large.

The most trustworthy as well as the fullest statement of his observations and inferences is to be found in the following summary, which the London *Times* has given of the paper read by Mr. Lockyer before the last meeting of the Royal Society in London:

In order that the line of argument followed by Mr. Lockyer may be understood, it will be necessary briefly to refer to the results of previous researches. As a rule, in observing spectra, the substance to be examined is volatilized in a gas flame or by means of sparks from an induction coil, and the light is allowed to fall on the slit of the spectroscope; the spectrum is then generally one in which the lines run across the entire field, but by interposing a lens between the spark apparatus and the slit of the spectroscope, Mr. Lockyer was enabled to study the various regions of the heated vapor, and thus to establish the fact, already noted by some previous observers, but to which little attention had been paid, that all the lines in the spectrum of the substance volatilized did not extend to equal distances from the poles. He then showed, by the aid of this method, that in the case of alloys containing different proportions of two metals, if one constituent were present in very small quantity its spectrum was reduced to its simplest form, the line or lines longest in the spectrum of the pure substance alone appearing, but that on increasing the amount of this constituent its other lines gradually appeared in the order of their lengths in the spectrum of the pure substance. Similar observations were made with compound bodies. It was also noticed that the lines furnished by a particular substance varied not only in length and number, but also in brightness and thickness, according to the relative amount present. Armed with these facts, and with the object of ultimately ascertaining more definitely than has hitherto been possible which of the elements are present in the sun, Mr. Lockyer, about four years ago, commenced the preparation of a map of a particular region of the spectra of the metallic elements for comparison with the map of the same region of the solar spectrum. For this purpose about 2,000 photographs of spectra of all the various metallic elements have been taken, and in addition more than 100,000 eye observations have been made. As it is almost impossible to obtain pure substances, the photographs have been carefully compared, in order to eliminate the lines due to impurities; the absence of a particular element as impurity being regarded as proved if its longest and strongest line was absent from the photograph of the element under examination. The result of all this labor, Mr. Lockyer states, is to show that the hypothesis that identical lines in different spectra are due to impurities is not sufficient, for he finds short line coincidences between the spectra of many metals in which the freedom from mutual impurity has been demonstrated by the absence of the longest lines. He then adds that, five years ago, he pointed out that there are many facts and many trains of thought suggested by solar and stellar physics which point to another hypothesis—namely, that the elements themselves, or, at all events, some of them, are compound bodies. Thus it would appear that the hotter a star the more simple is its spectrum; for the brightest, and therefore probably the hottest stars, such as Sirius, furnish spectra showing only very thick hydrogen lines and a few very thin metallic lines, characteristic of elements of low atomic weight; while the cooler stars, such as our sun, are shown by their spectra to contain a much larger number of metallic elements than stars such as Sirius, but no non-metallic elements; and the coolest stars furnish fluted band spectra characteristic of compounds of metallic with non-metallic elements and of non-metallic elements. These facts appear to meet with a simple explanation if it be supposed that as the temperature increases the compounds are first broken up into their constituent "elements," and that these "elements" then undergo dissociation or decomposition into "elements" of lower atomic weight. Mr. Lockyer next considers what will be the difference in the spectroscopic phenomena, supposing that A contains B as an impurity and as a constituent. In both cases A will have a spectrum of its own. B, however, if present as an impurity, will merely add its lines according to the amount present, as we have above explained; whereas, if a constituent of A, it will add its lines according to the extent to which A is decomposed and B is set at liberty. So that as the temperature increases the spectrum of A will fade if A be a compound body, whereas it will not fade if A be a true element. Moreover, if A be a compound body, the longest lines at one temperature will not be the longest at another. The paper chiefly deals with a discussion from this point of view of the spectra of calcium, iron, hydrogen, and lithium as observed at various temperatures; and it is shown that precisely the kind of change which is to be expected on the hypothesis of the non-elementary character of the elements has been found to take place. Thus each of the salts of calcium, so long as the temperature is below a certain point, has a definite spectrum of its own, but as the temperature is raised the spectrum of the salt gradually dies out and very fine lines, due to the metal, appear in the blue and violet portions of the spectrum.

At the temperature of the electric arc the line in the blue is of great intensity, the violet H and K lines, as they are called, being still thin; in the sun the H and K lines are very thick, and the line in the blue is of less intensity than either, and much thinner than in the arc. Lastly, Dr. Huggins' magnificent star photographs show that both the H and K lines are present in the spectrum of *a Aquilæ*, the latter being, however, only about half the breadth of the former; but that in the spectrum of *a Lyræ* and Sirius only the H line of calcium is present. Similar evidence that these different lines may represent different substances appears to be afforded by Professor Young's spectroscopic observations of solar storms, he having seen the H line injected into the chromosphere seventy-five times, the K line fifty times; but the blue line, which is the all important line of the calcium at the arc temperature, was only injected thrice. In the spectrum of iron, two sets of these lines occur in the region between H and G which are highly characteristic of this metal. On comparing photographs of the solar spectrum and of the spark taken between poles of iron, the relative intensity of these triplets was seen to be absolutely reversed, the lines barely visible in the spark photograph being among the most prominent in that of the solar spectrum, while the triplet, which is prominent in the spark photograph, is represented by lines not half so thick in the solar spectrum. Professor Young has observed, during solar storms, two very faint lines in the iron spectrum near G, injected thirty times into the chromosphere, while one of the lines of the triplet was only injected twice. These facts, Mr. Lockyer contends, at once meet with a simple explanation if it be admitted that the lines are produced by the vibration of several distinct molecules. The lithium spectrum exhibits a series of changes with a rise of temperature precisely analogous to those observed in the case of calcium.

In discussing the hydrogen spectrum, Mr. Lockyer adduces a number of most important and interesting facts and speculations. It is pointed out that the most refrangible line of hydrogen in the solar spectrum, *h*, is only seen in laboratory experiments when a very high temperature is employed; and that it was absent from the solar protuberances during the eclipse of 1875, although the other lines of hydrogen were photographed. This line, also, is coincident with the strongest line of indium, as already recorded by Thalnè, and may be photographed by volatilizing indium in the electric arc, whereas palladium charged with hydrogen furnishes a photograph in which none of the hydrogen lines are visible. By employing a very feeble spark at a very low pressure the F line of hydrogen in the green is obtained without the blue and red lines which are seen when a stronger spark is used, so that alterations undoubtedly take place in the spectrum of hydrogen similar to those observed in the case of calcium.

In concluding this portion of his paper, Mr. Lockyer states that he has obtained evidence leading to the conclusion that the substance giving the non-reversed line in the chromosphere, which has been termed helium, and not previously identified with any known form of matter, and also the substance giving the 1,474 or coronal line, are really other forms of hydrogen, the one more simple than that which gives the H line alone, the other more complex than that which gives the F line alone.

The feeling of the leading English chemists and spectroscopists, who listened to the reading of Mr. Lockyer's paper, was that the observations described were open to other interpretations, and that very much more would have to be done in the way of observation and experiment before the matter could be decided.

This appears to be also the opinion of the majority of the more prominent scientists on this side the Atlantic. Dr. John C. Draper, however, is apparently inclined to accept Mr. Lockyer's conclusions; and, if not misreported, awaits further information with considerable confidence, that Mr. Lockyer has taken the necessary precaution to build his theory on the solid ground of nature. Mr. Lockyer's latest announcement, through the *Herald's* London correspondent (Jan. 13), is that he has obtained evidence—whether sufficient or not is not stated—that the bright lines of the solar chromosphere are chiefly lines due to the not yet isolated bases of fourteen of the so-called elements, and that the solar phenomena in their totality are, in all probability, due to dissociation at the photospheric level and association at higher levels.

The Solar Eclipse of 1880.

The central line in the total solar eclipse of January 11, 1880, ends soon after reaching the coast of California, where its totality may possibly be witnessed close upon sunset. The only lands in the course of the shadow through its long course across the Pacific are the Coquille, Bonham, and Elizabeth Islands, lying near together, between 169° and 170° E. longitude, and belonging to the Marshall Islands group. The eclipse passes centrally over the largest of the Coquilles, as laid down in the British Admiralty chart of this group, according to a calculation in which the moon's place has been made to accord very nearly with Hansen corrected to Newcomb, which gives the following track:

Long. E.	Lat. N. limit.	Lat. Cent. line.	Lat. S. limit.
°	° ′	° ′	° ′
168	+6 44·6	+6 28·0	+6 11·6
170	6 20·3	6 3·8	5 47·3
172	5 57·8	5 41·4	5 24·8

So that the breadth of the shadow in the direction of the meridian does not exceed 33′. Reading off from the chart it will be found that the center of the largest of the Coquille Islands is in about 169° 35·5′ E. and 6° 8·5′ N., and, calculating directly for this point, it appears that the total eclipse will commence at 8h. 41m. 25s. A.M. on January 12, local mean time, and continue 1m. 16s., and this represents the most favorable condition under which the eclipse can be observed on land. For any other point within the shadow in this vicinity the duration of totality may be determined by the following formulæ, where L is the east longitude from Greenwich, l the geocentric latitude, and t the Greenwich mean time of beginning or ending, according as the upper or lower sign is employed:

$$\text{Cos. } w = +109{\cdot}0051 - [2{\cdot}34285] \text{ sin. } l + [1{\cdot}98006] \text{ cos. } l \text{ cos. } (L - 15^{\circ}\ 15{\cdot}9').$$

$$t = 11\text{h. } 10\text{m. } 48{\cdot}9\text{s.} \mp [1{\cdot}58154] \text{ sin. } w + [3{\cdot}16328] \text{ sin. } l. - [3{\cdot}95668] \text{ cos. } l. \text{ cos. } (L - 126^{\circ}\ 35{\cdot}7').$$

Spectroscopic Temperatures.

A. Crova has measured the calorific intensity of different portions of spectra, by means of a thermo-electric pile and a very sensitive galvanometer. Representing by 1,000 the calorific intensity which corresponds to a red ray with a wave length of 676 millionths of a millimeter, he gives the following table:

Wave lengths	676	605	560	523	486	459
Sunlight	1000	820	760	670	540	460
Electric light.....	1000	707	597	506	307	228
Drummond light...	1000	573	490	299	168	73
Standard lamp....	1000	442	296	166	80	27

The electric light was derived from 60 large Bunsen elements, with Carré's carbons, in the focus of a concave metallic mirror; the standard lamp was filled with colza oil. Crova concludes that temperatures can be rigidly determined by the spectrometric method, as soon as we have ascertained the exact law of emission for all the rays and the numerical constants for each wave length. He presents these results as a first essay toward the solution of this important question. —*Comptes Rendus.*

Fresh and Stale Bread.

The celebrated French chemist, M. Boussingault, has recently investigated the nature of the change which bread undergoes when it becomes stale. Up to the present time this has not been well understood.

A circular loaf, 12 inches in diameter and 6 inches thick, was taken from an oven heated to 240° Réaumur, and a thermometer immediately forced three inches into it. The thermometer indicated 78° R. (207·5° F.). The loaf was then taken to a room at a temperature of 15° R. (66° F.), and was found to weigh 7½ pounds. In 12 hours the temperature of the loaf sank to 19° R. (73° F.), in 24 hours to 15° (66° F.), and in 36 hours to 14° (63·5° F.). In the first 48 hours it lost only two ounces in weight. After six days the loaf was again put in the oven, and when the thermometer indicated that its temperature had risen to 55° R. (156° F.), it was cut, and was found to be as fresh, and to possess the same qualities, as if it had been taken out of the oven for the first time; but it had now lost twelve ounces in weight. Experiments were also made on slices of the loaf with similar results, proving that new bread differs from old, not by containing a larger proportion of water, but by a peculiar molecular condition. This commences and continues to change during cooling, but by again heating the bread to a certain temperature it is restored to its original state. It is this mechanical state which makes new bread less digestible than old. The former is so soft, elastic, and glutinous in all its parts that ordinary mastication fails to reduce it to a sufficiently divided condition. It forms itself into hard balls, which are almost unaffected by the gastric juice. These balls often remain in the stomach, and, like foreign bodies, irritate and discommode it, inducing all sorts of unpleasant feelings.

Life Without Air.

This doctrine, so ably advocated by Pasteur, still finds opponents. It is admitted that oxygen is essentially necessary for fermentation, but those who believe in the theory of "life without air," maintain that the yeast cells can under circumstances obtain a supply of that element from the surrounding organic substances, and therefore the process of fermentation can proceed without air. Gunning, however, has been continuing his experiments upon this subject, and as a result questions the fact that the total absence of oxygen from the receptacles used by Pasteur has been satisfactorily demonstrated.

Metal Exhibits.

At the late Paris Exhibition a Belgium exhibit showed rolled iron of various sections up to 60 feet long, and a double head rail about 180 feet long. Among the foreign exhibits was a wrought iron taper tube half inch diameter at one end, and 12 inches diameter at the other, 276 feet long, bent into a spiral; a wrought iron plate bent into a double arch about 3 feet 6 inches wide, one eighth inch thick, 57 feet long; a wrought iron plate bent to form an arch, and coiled at each end, 120 feet long; a galvanized plate half inch thick, 4 feet 6 inches wide, and 30 feet long; a steel plate three eighths inch thick, 6 feet 6 inches wide, 30 feet long, and a large variety of very fine specimens of rolled work. Among English exhibits was a piece of hoop iron 330 feet long, 3 inches wide, by 38 gauge, and a steel wire rod, 1,250 feet long, No. 2 gauge, weighing about 270 lbs.

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An experience of more than thirty years, and the preparation of not less than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. In addition to our facilities for preparing drawings and specifications quickly, the applicant can rest assured that his case will be filed in the Patent Office without delay. Every application, in which the fees have been paid, is sent complete—including the model—to the Patent Office the same day the papers are signed at our office, or received by mail, so there is no delay in filing the case, a complaint we often hear from other sources. Another advantage to the inventor in securing his patent through the Scientific American Patent Agency, it insures a special notice of the invention in the SCIENTIFIC AMERICAN, which publication often opens negotiations for the sale of the patent or manufacture of the article. A synopsis of the patent laws in foreign countries may be found on another page, and persons contemplating the securing of patents abroad are invited to write to this office for prices, which have been reduced in accordance with the times, and our perfected facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN.

Business and Personal.

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

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Caution to Manufacturers and Others.—The attention of those interested is called to the fact that materials for covering hot air and steam pipes, boilers, etc., which purport to contain asbestos, should bear the name of H. W. Johns, 87 Maiden Lane, N. Y., who is the inventor, patentee and sole manufacturer of genuine asbestos materials, comprising paints, coatings, cements, sheathings, roofing, etc.

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NEW BOOKS AND PUBLICATIONS.

CORONA FUNEBRE.—We recently published an eloquent extract from the writings of Ogier concerning the remarkable beauty and power of the Spanish language, whether employed in prose or poetry. A very striking exemplification of our author's estimate now comes to us in the form of a handsome little volume of Spanish poesy, sent to us by the editors of *La Academia* of Madrid. The volume is entitled "Corona Funebre," the Funeral Crown. It is a collection of recent verses and poems, by more than seventy different authors, commemorative of the virtues of the youthful Queen Mercedes, and expressive of the universal sorrow caused by her untimely death, July, 1878. These contributions have been selected from the pages of *La Academia*, which is one of the largest and finest illustrated journals in the world.

George P. Rowell & Co.'s American Newspaper Directory for January, 1879, has made its appearance. From it we learn that the total number of periodical publications in the United States is 8,703. There are 13 more daily and 307 more weekly newspapers than were reported in the edition for January, 1878. The total increase in the United States of all sorts is 363. The Centennial year, 1876, has been the only one within the period covered by the eleven annual issues of the Directory in which the number of publications had not increased.

Notes & Queries

(1) P. J. B. asks for a receipt for making bar soap. A. Good common soap is prepared by saponifying about 50 lbs. of tallow or well rendered grease, from 4 to 7 lbs. of palm oil, and 8 or 9 lbs of rosin, with 7 or 8 lbs. of caustic soda, or something over 6 gallons of lye 24° to 30° B. The rosin is usually saponified by boiling it with about a gallon of the strong lye, and afterward adding it to the oil and grease when partially saponified by boiling with a larger portion of the somewhat diluted lye. The mass must be constantly stirred during the whole operation. When saponification is complete the pasty mass is transferred to frames, allowed to cool, and finally cut into bars with wire tools or stamped into cakes. These soaps are often largely adulterated with starch, clay, silicate of soda, etc., for the purpose of causing them to retain a large per cent of water without affecting their appearance or hardness when ready for market.

(2) O. F. L. asks how the oil can be extracted from the cod liver. A. Heat the fresh livers to about 192° Fah., subject them to a moderate pressure, collect the oil which escapes in warm water, and, after brisk agitation, for a few minutes allow the oil to separate and filter it. Bleached by exposure to sunlight under glass and sometimes by filtration, while warm, through fresh granular animal charcoal.

(3) F. G. R. asks: By what compound liquid or otherwise can impure air in sleeping rooms be shown? A. A small quantity of clear lime water shaken up with a large measured quantity of air will become turbid from the absorption of carbonic acid, and the degree of this turbidity compared with a previously prepared scale will serve to roughly indicate the amount of that gas present in the atmosphere of the room. Carbonic acid may, however, be considered the least dangerous impurity in an ill ventilated sleeping apartment. There are no ready means, beyond the oppressive sensation experienced by one coming directly from the outer or purer air into such an atmosphere, by which the amount of poisonous carbonic oxide, organic exhalations, etc., contaminating it, may be readily ascertained.

(4) G. M. A. asks: What will remove antimony from a person's system? A. It has lately been established that antimony, unless taken in extremely large doses, will quickly eliminate itself from the system.

(5) J. L. K. asks: 1. How can I prepare crude gypsum for plastering, and will it answer for rough coating instead of mortar mixed in the usual way? A. The gypsum is ground in a mill to flour like powder, and then heated over a suitable furnace in large stout iron kettles capable of holding a number of barrels at a time. The powder is constantly stirred by revolving arms until the tumultuous disengagement of vapor subsides, when it is bolted usually into three grades, superfine, casting, and common, and packed in paper-lined barrels for market. The mean temperature in the calcining vessels should not exceed 272° Fah. Plaster of Paris is used for moulds in potteries, for glazing porcelain, and for filling fireproof safes. It is made into mortar with lime and sand, used for cementing floors, vaults, etc.; it is extensively used as a fertilizer and for the manufacture of a number of valuable cements. It is also much used in foundry work for stereotyping, etc. You will find an interesting article on the subject on pp. 173-178, *Science Record*, 1874. 2. How can I put mercury in a barometer (siphon) tube? A. When the tube has been thoroughly cleaned and dried pass a piece of very narrow rubber tubing down the short leg just over the curves, and, after inverting, force through this the purified mercury about a thimbleful at a time, heating each addition in the tube nearly, or quite, to the boiling point. Continue this operation until the tube is well filled.

(6) M. I. asks how to make artificial cider. A. The Western cider is prepared as follows: Sugar, 1 lb.; tartaric acid, one half ounce; good yeast, 2 tablespoonfuls; water, 1 gallon; agitate to effect solution and allow to ferment for 12 hours or more. Your other question will be answered subsequently.

(7) W. E. G. writes: We have a vertical engine, diameter of cylinder 7 inches, 15 inches stroke, boiler pressure 60 lbs., 100 revolutions per minute, 4 foot balance wheel, 9 inch face, 4 foot drum, 9 inch belt, diameter of live steam pipe, 2 inches, diameter of exhaust pipe 2½ inches. We propose to put on another cylinder on the other side: I wish to know if live steam or exhaust pipe will have to be larger, will the governor answer for both cylinders, and how much more power will we gain? A. It would be well to use pipes of about twice the cross section of the present ones. Unless the present governor is unusually large, it will not answer. You can calculate on doubling the power, if the change is properly made.

(8) C. B. asks: 1. What is the best and more economical battery for electrotype? I want to deposit copper on plaster or wax moulds measuring from 200 to 300 square inches. A. The Smee cell with carbon negative or one of the forms of copper sulphate batteries is generally preferred. 2. How many cells would it take? A. From three to five 3 quart couples will suffice to make the surface of zinc exposed in the battery equal to or slightly in excess of the surface of the work to be plated. 3. How strong should be the solution? A. If the Smee form is used, 1 of acid to about 5 or 6 of water. For the bath use a saturated aqueous solution of copper sulphate. The copper in the Daniell form of battery is surrounded by a similar solution, the zinc by dilute aqueous solution of zinc sulphate. 4. How often should the solution be changed? A. It will depend altogether upon the amount of work done. 5. Is it more economical to amalgam the zinc plate? A. In the Smee battery, yes. In the sulphate of copper battery the zinc need not be amalgamated.

(9) G. W. L. asks for a recipe for making a good cement for filling large openings in millstones. A. Emery of the proper grain mixed with melted borax in slight excess has been used.

(10) T. F. V. asks what is the best pipe to use for conveying drinking water. A. In many cases lead and galvanized iron pipes are very objectionable. Iron or enameled iron is better, but where circumstances will admit of its use, wood is preferable to any of these.

(11) I. T. H. asks why lime slaked will prevent steel from rusting. A. Caustic or quick lime (not slaked lime), owing to its attraction for moisture, keeps the metal embedded in it perfectly dry.

(12) P. asks how to remove mildew from light kid gloves without injury to them. A. The following treatment will generally suffice: dry the gloves thoroughly, stretch, rub the spots well with a moderately stiff brush, and then with a moderately small quantity of egg albumen or flour paste.

(13) F. G.—SCIENTIFIC AMERICAN SUPPLEMENT No. 162 contains instructions for making several forms of telephone call.

(14) J. H. W. writes: 1. Bird says in his work on steam engines, to get the horse power multiply by number of revolutions; does not piston speed mean twice that number? A. Piston speed in feet per minute = stroke in feet × twice the number of revolutions per minute. 2. Should the smoke stack to a locomotive or agricultural steam engine equal the area of the flues in boiler where we use a blower? A. It is well to give it that proportion.

(15) T. E. C. asks: 1. Why is it, that if a locomotive is allowed to get stone cold, then reversed and another locomotive of equal weight and power shackled to it, it can draw it but a short distance ahead before getting stalled? A. When the engine is reversed and drawn ahead it acts as an air compressor, drawing in the external air and compressing it to such a degree as to offer great resistance to the motion of the piston. 2. And also, why if a locomotive, moving down grade and using no steam, is reversed and no steam given, the engine will sound as if steam were being used? A. The air rushing into the exhaust to fill the vacuum formed in the cylinder by the action of the piston, makes the sound referred to.

(16) C. D. C. asks: What is the best and cheapest material for giving agricultural irons a permanent and durable black finish, something that will be cheaper than paint, and quicker put on, also give me the process of applying it? A. Good common asphalt varnish will probably answer your requirements. It may be prepared by dissolving asphaltum in naphtha, benzine, or turpentine. If not used too thick it dries quite rapidly. Dip the articles, or apply the varnish with a brush.

(17) S. S. S. asks how to make ammonio-sulphate of nickel. A. Dissolve nickel sulphate in a small quantity of hot water, add strong ammonia water until the light precipitate at first formed is redissolved, and concentrate by a gentle heat the blue solution until crystals of the double salt form.

(18) E. D. W. asks for a process for ebonizing cherry wood so that it will admit of a high polish. A. Brazil wood, powdered nutgalls, and alum are boiled in water until a blackish color is obtained; the liquid is filtered and applied to the wood, which is then washed in a liquor made by digesting strong vinegar and a little oil of vitriol for some time with excess of iron turnings; thoroughly wash the wood, dry and oil. For staining fine woods the following is applicable: 4 ozs. of gallnuts, 1 oz. powdered logwood, one half oz. green vitriol, and one half oz. verdigris are boiled with water, and the solution, filtered hot, is applied to the wood, which is then coated with a solution of 1 oz. fine iron filings dissolved by digestion in a small quantity of hot wine vinegar. See also pp. 191 and 219, volume 38.

(19) F. C. S. writes: To make a Leyden jar, I took a glass jar (3 quart), and covered the inside and bottom with tin foil, and also the outside within two thirds of the top. I closed it with a cork, covered with paraffine, through which I passed a copper wire terminating with a chin which touched the bottom. I connected the inside and outside with an electro-magnetic machine, but could not collect any electricity in the jar; what is wrong about it, and how many such jars, properly made, would it take to produce a shock that would kill a cat? A. The Leyden jar is properly made, but it should have a knob on the outer end of the wire. You cannot charge it with a magneto machine; a frictional machine or an induction coil will be required. To kill a cat you would require a battery of several such jars, having an aggregate tin foil surface of about four and a half square yards.

(20) J. L. asks for the best method to galvanize iron work. A. The iron is cleaned by pickling it in dilute sulphuric acid and scouring with sand if necessary, rinsed in water, dipped in a concentrated, slightly acid aqueous solution of zinc chloride, and immediately after in a bath of molten zinc covered with sal-ammoniac.

(21) W. L. C. asks for the name of something that will prevent wood or woody fiber from drawing together or shrinking after being swelled in water or steam? A. We know of nothing—the shrinking is due to loss of the water absorbed during the swelling process.

(22) H. J. H. asks how to transfer a signature, or to transfer a monogram drawn with lead pencil, to a block for engraving. A. Make a tracing of the signature or monogram on a good quality of tracing paper with a fine pointed pencil; place the tracing face down on the block, and follow the lines (as seen through the paper) with a hard well pointed pencil, the lines of the tracing will be in this way transferred to the block.

(23) A. B.—SCIENTIFIC AMERICAN SUPPLEMENT No 158 contains a large number of cement receipts, among which you will find one for your purpose.

(24) B. E. C. asks: 1. Will an engine 12 inch, 24 inch stroke, be power enough to drive a 56 inch saw, and if so at what speed? A. Such an engine, if well proportioned, will drive a 56 inch saw at full speed, about 650 revolutions a minute. 2. Does the water in a well remain the same temperature in summer as winter? If not, what is the difference? A. Generally there is little if any difference.

(25) J. D. M. asks: Will you please tell me how to make permanent soap bubbles? A. See reply to Maudie on page 44 of current volume.

(26) E. & J. W. S. ask: How were the piers for the iron bridge at St. Louis built? A. Caissons were used, the water being prevented from entering at the bottom by the action of compressed air.

(27) H. W. S. writes: Our engine, 12x22, makes 92 revolutions = 337 feet per minute, cuts off steam when piston has traveled 18 inches. Could we save steam by running faster and cutting off at one half stroke? What speed and what cut off would you recommend? It is a well built engine. A. The change would be desirable. As you do not send steam pressure, indicator diagram, or similar data, we cannot answer your question in detail.

(28) H. C. B. asks: What is the horse power of an engine, 6 inches stroke, 2¾ inches cylinder, 120 revolutions per minute, 50 lbs. mean pressure in cylinder? A. $\frac{3.98 \times 50 \times 120}{33{,}000} = \frac{572}{825}$ of a horse power.

(29) E. A. W. asks: 1. Can the gas with which streets are generally lighted be compressed, and held so? A. Yes. 2. What material should the reservoir be made of? A. Sheet or cast metal. 3. Why are the cylinders of some locomotives on the incline? A. The arrangement is generally made, we believe, on account of some real or fancied advantage in the details, or to suit some peculiar form of locomotive frame or running gear.

(30) W. McC. writes: I intend to make a battery consisting of zinc around the inside of a stone jar (1 foot deep), in which is a solution of common salt, and a flower pot containing copper and sulphate of copper, inside of zinc. Would a battery thus made be powerful enough to produce an electric light equal to one gas burner, or if not, how many would I need? A. It would require from 75 to 100 such cells to produce an electric light.

(31) C. F. asks what power expressed in fractions of a horse power it takes to run a sewing machine, a foot lathe, and heat 1,000 cubic feet of a reasonably tight country house. A. With an engine capable of developing half a horse power, and a boiler of suitable size for the engine, you could run the machinery, and heat the space to which you refer.

(32) C. A. writes: A friend and myself had lately a discussion as to the apparent situation of the sun to a man standing directly on the north pole. He maintained that the sun would seem to rise in a straight line from about March 21 to June 21, and then descend. My opinion is, that the sun would appear to whirl around the horizon, making one revolution each day, commencing to appear on the 21st of March and screwing up till the 21st of June, to the height of the horizon given by the angle of the polar axis to the sun, and then descending in the same manner; I maintained that although standing on the axis, the observer would be turned around by the motion of the earth on its axis, and would see the sun every 6 hours one quarter of a turn removed. A. You are right.

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

O. D. R.—It consists of carbonate of lime, carbonate of magnesia, carbonate of iron and silica. P. P. P.—It is sulphide of iron—of little value. M. S.—No. 1 is black oxide of manganese—of some value if found in sufficient quantity. No. 2 is lead sulphide or galena—a valuable ore of lead. It probably contains a little silver. D. R.—They are garnets of different colors and varieties—sometimes used in jewelry. M. H. F.—Send your specimens. J. F.—No. 1 is hepatic pyrites. No. 2 iron pyrites containing a little mispickel. F. S. P.—The specimen contains some magnetic oxide of iron disseminated through a quartzose matrix, but no appreciable quantity of silver. M. F.—The little scales are kaolinite—a hydrous aluminum silicate. R. W. F.—The galena contains 87 per cent of lead. C. F. K.—No. 1 is banded argillite or clay rock. No. 2 is micaceous oxide of iron. No. 3 is actinolite—a silicate of magnesia and lime. J. W. S.—The fine sand might advantageously be used in the preparation of silicate of soda and for some grinding and polishing purposes. It is hardly sharp enough for sand paper. N. O. D. H.—The samples of supposed native brass from Sierra county, Cal., according to an analysis by Dr. Stillman, have the following composition: Copper, 85·02; zinc, 11·02; antimony, 3·82; iron, ·09; total, 99·95. Another sample was assayed for silver and gold, but neither of these metals was found. The probability is that the alloy was an artificial one. P. E. W.—No. 1 is very fine silica containing a little alumina and oxide of iron. It appears to have been of infusorial origin. No. 2, the clay contains much fine silica. No. 3, similar to No. 1, but contains more alumina. I. H. P.—Shale containing a small amount of carbonaceous matters and much iron sulphide. T. J. H.—They are quartz crystals—sometimes used to imitate diamonds in cheap jewelry.

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COMMUNICATIONS RECEIVED.

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

New Mechanical Movement. By L. Haase.
Human Knowledge. By G. V.
On the Electric Light. By D. H. D.
On the Formation of Streams, Springs, and Lakes. By A. R.

[OFFICIAL.

INDEX OF INVENTIONS

FOR WHICH

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

December 17, 1878,

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.

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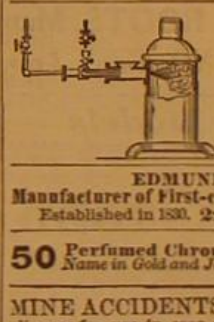

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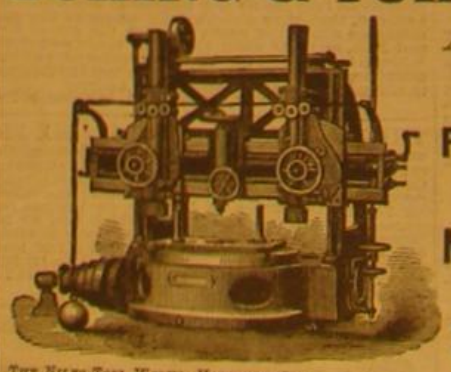

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VIII. MISCELLANEOUS.—Gulf Weed.—"Loco" Poisons of the West.—Raising Ducks.—Alfalfa.

THE NEW PATENT BILL AS PASSED BY THE SENATE.

An Act to Amend the Statutes in Relation to Patents (Senate Bill 300) has been passed by the Senate, and is now before the House of Representatives for its approval. As the adjournment of Congress is fixed for the 4th of March, the bill must soon be acted upon, or it will go over to the next Congress. The bill as it stands, while it contains some very excellent provisions, presents others that are very obnoxious; and unless the bad points can be eliminated we hope the subject will be postponed for the consideration of the new Legislature.

We will briefly recapitulate what to us appear to be the leading designs of the present bill, with a few words of running comment. In all there are 25 sections.

Sec. 1 provides that damages shall not be recovered for infringements that were alleged to have taken place more than four years prior to the commencement of the suit.

As the law now stands the owner of a patent may sue infringers at any time when he can find out that an infringement has taken place. But under the new provision, if the infringement is concealed or in any way escapes the knowledge of the patentee for four years, he has no remedy, and the infringer goes free. This section is an encouragement to infringers, is an injustice to patentees, and should not be passed.

Sec. 2 takes away from the inventor, substantially, the control and exercise of the patent for his own invention, and gives away to others the right to use the patent, against the consent of the patentee, for a price not agreed to by him, but fixed by people adverse to him, by means of the formalities of a court.

The existing law vests the exclusive proprietorship of the patent in the inventor, during the brief period of 17 years for which it is granted. This is one of the most satisfactory provisions of the present statute, and should be carefully preserved. If the new provision passes no man can hereafter say that he "owns" a patent. He will simply own a certificate showing that somebody else has the right to make use of the products of the inventor's ingenuity without so much as asking his leave.

Sec. 3 provides that if the inventor has the hardihood to bring a suit against an infringer and clearly proves the infringement, should the infringer then wriggle around and debar the inventor from getting a judgment for a sum less than twenty dollars, then, in that case, the inventor shall pay his own costs of the suit and also the infringer's costs.

This section practically imposes a heavy fine upon an inventor for attempting to stop infringements.

Sec. 4 gives conditional privileges to infringers to continue their infringements after a verdict is rendered against them, during the pendency of their appeals.

Sec. 5 gives to infringers the privilege of procuring the removal of injunctions, so that they may continue to infringe.

Sec. 6 provides that no re-issue shall be granted unless applied for within seven years from the date of the patent.

The present law permits the inventor to correct his patent by re-issue at any time during the life of the patent; this is an excellent provision, and tends to give value and vitality to property in patents. The provision of the new law assists and encourages the infringer.

Sec. 7 provides that if an inventor's specification happens at first to be so defective that an infringer can make and use the device without liability, the said infringer may always continue such use, without payment to the inventor, even after the latter procures a re-issue with properly corrected specification and claims.

Under the present law, if the original patent is found defective and the claims insufficient to prohibit infringements, the inventor may at any time obtain a re-issue, which shall be good for the remaining term of the patent, during which remaining term infringers must pay damages. The new provision aids and supports infringers throughout the entire term of the patent, and prohibits the inventor from recovering damages.

Sec. 8 provides a remedy where two persons have unwittingly taken a patent in their joint names, when only one of them was the real inventor.

Sec. 9 provides for the taking of testimony relating to patents, which may be stored away and used in new cases after the witnesses are dead and gone.

This appears to be another of the many provisions of the bill intended to assist infringers.

Sec. 10 provides that infringers may bring suits to have patents declared void.

This provision appears to be intended to help infringers in breaking down patents that stand in their way, but which belong to poor inventors who cannot defend such suits, or patents granted to those who are absent or deceased.

Sec. 11 requires that patentees who have requested infringers to stop such infringement, shall commence suits for damages within a reasonable time; otherwise the infringer may continue the infringement during the entire term of the patent, without liability to the patentee.

The majority of patentees are poor people, who in many cases have not the means to bring suits against infringers, and all they can do is to request the latter to desist or pay royalty; reserving until a future time, when their means admit, the bringing of suit.

The law, as it now is, permits a poor man to bring his suit for infringement whenever he desires. The new provision appears to be aimed against the inventor, and in favor of the infringer.

Sec. 12 provides that patent fees shall hereafter be paid as follows: $35 on the issue of the patent, $50 in four years thereafter, and $100 in nine years thereafter; total, $185 for each patent. Failure to pay either of the two last fees nullifies the patent.

Under the present law the fee for a patent is only $35. No other taxes or penalties are imposed. The proposed law introduces the European system of multiple taxes, and imposes a heavy burden upon the inventor. This subject will be found more fully discussed in another part of our paper.

Sec. 14 regulates the issue of licenses by joint owners and patentees. 15 provides punishment for fraudulent or deceptive conveyances of patent rights. 16. Commissioner and assistant to give bonds. 17. Prices of printed copies of patents authorized to be increased. 18 relates to certified copies of patents. 19 relates to payment of final fee in allowed cases. 20 regulates issue of patents for inventions previously patented in foreign countries. 21 permits full owners of patents to obtain reissues in their own names. 22 regulates the renewal of lapsed allowed cases. 23 regulates the stamping of date of patent on patented articles. 24 regulates the issue of patents in interference cases. 25 repeals all conflicting laws.

It will be seen from the brief comments here presented, that in our view the passage of the new law will make a very radical change in the existing system, and that its practical working would probably be disadvantageous to inventors and patentees. At the same time it must not be forgotten that patents are monopolies, which, though on the whole of great benefit to the nation, are in some cases very annoying to the public, and very burdensome and disastrous to many private interests. Perhaps the present laws can be modified so as to remove some of these difficulties. But the remedy proposed by this bill is worse than the disease. It seems unfair to enact a law like this, which in so many of its principal provisions appears to be designed to sweep away from inventors all personal benefits from the fruits of their ingenuity, and bestow them, free of charge, upon infringers.

We hope that all who are opposed to the new law will promptly use their influence with members of Congress to prevent its passage.

WILL BLOOD TELL?

Some five years ago, Dr. Heitzman announced, in the *Medical Record* of this city, an important discovery in respect to the anatomy of protoplasm. He claimed that protoplasm of every description invariably contains a network of threads and granules inclosing a fluid, and that the threads and granules constitute the living matter. This view he now asserts has been accepted by more than a dozen of the best microscopists abroad, although it has not yet been recognized in this country; and he makes it the basis of an announcement which, if satisfactorily demonstrated, cannot fail to have a marked and beneficial effect upon the practice of medicine—the announcement that a drop of a man's blood under the microscope will tell just what his condition and constitution may be.

A protracted study of the pus corpuscles in urine, in connection with clinical histories, led Dr. Heitzman to the conclusion that the constitution of a patient could be determined by such examinations, the pus corpuscles of a healthy and strong person containing a greater abundance of living matter than those of a person enfeebled by disease or otherwise. He next extended his investigations to the colorless blood corpuscles, suspecting that by their examination also he might be able to determine the constitution of the individual furnishing the blood. His expectation was verified, he says; an abundance of large granules going with a good constitution; on the other hand, if the granules were few and fine, or the entire body of the corpuscle pale, it was evidence of a poor constitution. He frequently noticed that the number of white blood corpuscles was considerably increased after a single sleepless night, so much so that it might be determined whether a man had been kept from his rest or not, by examination of his blood. It could also be determined whether a man was to have acute diseases, or whether he was to suffer from the slow processes of disease incident to a strumous diathesis.

A committee of physicians has been appointed to investigate and report on this most promising subject. If it proves possible to determine a man's physical constitution by the examination of a drop of his blood a new field of investigation will be opened, and one having very important practical bearings.

AMERICAN TEA.

Over fifty thousand tea plants have been distributed lately in the Middle and Southern States, by the Bureau of Agriculture. In three or four years these plants will be large enough to permit a full picking of the leaves. Experiments have been made with tea leaves grown in the grounds of the department and in the South, after Japan methods, the product being pronounced an excellent Oolong by dealers and experts. The only present obstacle to the profitable cultivation of tea in this country on a large scale is the amount of hand labor required in curing the leaves. The Commissioner is confident that American ingenuity can produce machinery by means of which the preparation of the leaves may be effected better and cheaper than is possible even with "Chinese cheap labor." There is no good reason why any family having a garden plat, in the southern and middle portions of the United States, should not produce with little trouble all the tea needed for home consumption, without elaborate machinery.

THE LICENSE FEE AS A MEASURE OF DAMAGES.

During the debate, on the 16th ult., in reference to the second session of Senate bill No. 300, Senator Conkling quoted the familiar aphorism that "everybody knows more than anybody," and he added: "The ablest committee in this body, or any other, may sit and listen to attorneys representing somebody else, and come to a most conscientious and intelligent conclusion, and still, in a matter so complex as this, it is more than likely that, when the converging rays of a great many minds are turned upon that subject, new considerations and new thoughts may be suggested, which it is well worth while to utilize."

The remarks of the distinguished New York statesman lose none of their pertinency from the fact that the arguments before the committee were almost wholly by eminent barristers retained for that purpose by associations more or less inimical to patents.

It is observable that advocates and apologists of the Wadleigh bill—perhaps conscious of the fallacious character of their conclusions—seem desirous to subordinate legislation to such mere judicial fictions and technicalities of the forum as that which finds it necessary to regard the infringer of a patent as a "trustee," before the rights of recovery of profits can be adjudged against him; and the fiction which would exalt the license fee from its position as one of several tests of value to be the absolute "measure" of compensation to the defrauded patentee; thus placing the clandestine user on a level with the licensee, and arbitrarily fixing the price at which the private property of one man may be appropriated by any other.

Instead of the procrustean rules with which it is sought to tie the hands of tribunals, much better would be the mode recommended by Senator Matthews, who, in closing the debate, remarked: "I am of opinion that every avenue of evidence ought to be kept open, for proof, in each individual case, according to its circumstances, and that the amount in such a case should be reasonable and fair, and that that should be left absolutely, upon that evidence, to the discretion of the tribunal charged by law with the finding of such a verdict or the making of such a decree, without any restraint, without any artificial rules to bind that discretion, without shutting out any light; so that every fact and every circumstance which is material and important to the determination of the question shall be permitted to be proved."

Now, is not the much insisted rule of the license fee, as the absolute measure of damage or profit, directly in conflict with the Ohio Senator's well stated principle of action? Does not the drift of reasoning that prescribes such a rule virtually destroy the "EXCLUSIVE" attribute which the Constitution makes inherent in the franchise?

It is conceded by Mr. Christiancy that the right, so long as it remains wholly in the hands of the inventor, is his, to do as he pleases with, as much so as the right of possession in a mine or a field; nay, more, that, in such a close monopoly, the patentee is entitled as a measure of damage against an infringer, to the entire usufruct or beneficial results of his improvement, although such results are very well known to be often manifold the amount of the customary license fee.

The sometimes relative insignificance of the license fee is well known to be attributable to the anxiety of the patentee—before many months of his brief franchise have slipped away—to get the manufacture into the hands of competent men, and, in order to accomplish this, and that the device may fight its way against the *vis inertiæ* of routine and prejudice and reach early and extensive sale, the patentee is willing to forego a very large proportion—often exceeding nine tenths of the actual benefit. He is willing to surrender so much to the legitimate manufacturer and to the public, but not one cent to the marauder.

Now, apart from questions of justice, apart from questions of constitutional right, can any one doubt that it is for the public interest that the patentee should be encouraged to relax somewhat of this strict monopoly, should be permitted, without let or hinderance, to select the mode, the agents, and the places in which and by whom his franchise shall be utilized?

An illustration may be cited familiar to many. Some twenty-five or thirty years ago the manufacture of tongued flooring was subject to the Woodworth patent. This manufacture, in Hamilton county, Ohio, was restricted to fourteen mills, of which each paid to the patentee a stipulated annuity of $1,000. The ability of these licensees to undertake the manufacture rested implicitly on the patentee's guarantee as to the maximum number of mills. Now what would have become of their contracts and of the business founded on those contracts, if any trespasser—say, a wealthy building association—could have stepped in and defied the inventor and the honest licensees, in the assurance that Justice—should she be invoked—could at most but adjudge the license fee as the reasonable compensation for the tortious use?

The frequent, somewhat promiscuous disposal of their rights at almost nominal figures, by necessitous or unthrifty inventors, does not, as some would have us believe, necessarily imply a total surrender to the public at a given price, nor does it invest any one with the liberty to appropriate such right on the terms thus granted to others, or any terms; nor does Congress, nor all the tribunals between the two oceans, step in between the humblest patentee that can be cited by Senator Christiancy and that patentee's "EXCLUSIVE" property in his own invention.

As the patentee of a valuable device, jealous of the reputation of this offspring of my brain, and regardful of the interests of those who may, with my consent, have undertaken its manufacture, can I be denied the exercise of my own discretion in the selection of licensees? Would not they, and might not even the public, be best served by my doing so? Well, now, what becomes of this option, if any irresponsible party may step in and manufacture my device on no royalty at all—for many patentees are unable to incur the expense of a patent suit, and with the further assurance that, in the event of prosecution, the measure of compensation is the ordinary license fee?

Gentlemen who concede my exclusive right to my invention in its integrity so long as I confine the manufacture to my own attic, and that even to the extent of the entire benefits, usually manifold the amount of an ordinary license fee, will scarcely allege that the interests of the community are subserved by such a narrow policy. But does not the proposed rule offer a premium for just such a policy?

Gentlemen call this a Statute of Repose. Truly, of repose with a vengeance—the REPOSE OF DEATH!

GEO. H. KNIGHT

Cincinnati, January 23, 1879.

AMERICAN INDUSTRIES.—No. 5.

THE MANUFACTURE OF LUBRICENE.

One of the inevitable problems connected with the general introduction of machinery is that of proper lubrication; this is second only to correctness of design and good workmanship in the machinery itself. Manufacturers and users of machinery well know how difficult it is to cope with this problem. It is perhaps simple enough to lubricate surfaces so that friction is minimized; but there are other elements in the problem, which are quite as important as this, among which we mention the matter of economy, the time consumed in applying the lubricant, and the effect of the lubricant on the surface to which it is applied.

These points, although apparently quite simple, are really complex and have recently commanded a great deal of attention in the mechanical world; so much indeed that it has been made the subject of the most delicate tests known in mechanics.

Oils for lubricating purposes are generally comprised in three classes, viz.: vegetable oils, animal oils, and mineral oils.

Among the vegetable oils, olive oil holds without dispute the first place; it has the great advantage that it can be purified without the assistance of mineral acids, and thus attains a higher value, which cannot be approached by other oils of vegetable origin. Next to olive oil come the oils extracted from sesame, sometimes called "gingelly oil;" from ground nuts, which, to a certain extent, can also be purified without acids. Colza and cotton-seed oils follow at a long distance; they must needs be purified by acids, which free them from the pectic and azotic matters which they contain in considerable quantities.

Unfortunately, this necessary treatment with, say, sulphuric acid, while it bleaches the oil, also alters materially its composition, predisposing it to easy decomposition. Besides, if the proper proportions of acid are not carefully employed, fatty acids are produced, which, dissolving in the oil, are detrimental to its application as a lubricant.

The second class comprises the oils and greases derived from animal substances. They are used for the finest machinery, for which they are specially valuable, and where the quantity is so small that the price is no consideration. They must all be much refined, either to remove the free fatty acids which sometimes are present in comparatively very great amounts, or other animal matters which very often accompany them in solution, which, not being wanted, are impurities. To this class belong the lard and neat's-foot oils, pressed cold, and purified with salts of lead; also, spermaceti and others. The lower qualities of these oils are sometimes used in place of vegetable oils, as not being more expensive, but their price is kept down by deficient rectification, and as thus they are apt to oxidize soon and to desiccate, they can never be used with any advantage for ordinary machinery.

Well purified animal oils are also applicable to the lubrication of heavy machinery where the bearing surfaces are large and the weight great.

Mineral oils form the third class. They are not suitable for the heaviest class of machinery, on account of their want of cohesion, and generally high degree of inflammability.

Olive oil thus stands first as a lubricant. It has of late been much displaced by mineral oils, on account of its price, but it is a question whether, all things considered, it is not cheaper in the end. Of course it must, like other vegetable oils, be purified, and is more valuable the better this has been done. These purifying processes deprive it not only of the fatty acid, but also of its odor; but, as other vegetable oils are equally neutralized and bleached, these qualities can be no guide to its lubricating properties.

Crude vegetable oils contain, as a rule, from one to six per cent. of impurities, which depreciate their efficiency, and which must be removed by the application of acids. The amount of acid left in the oil is of the highest importance, for it is this acid which attacks the lubricated surfaces and wears them away.

In 1877, the American Institute, by a series of exhaustive tests of various lubricants, conducted by Prof. R. H. Thurston, of the Stevens Institute of Technology, determined the qualities of a great number of lubricants, and as a final result, after several months of investigation, awarded the medal of superiority to Mr. R. J. Chard, of this city, for the product now widely known as lubricene, which is said to combine the desirable qualities of the lubricants above enumerated, while it is without their objectionable features.

Prior to this, in 1875 Mr. Chard received a silver medal from the American Institute, and he received a medal for his products at the Centennial.

In view of the great importance of this subject, and of the merits of this particular lubricant, we describe, as far as the manufacturer will permit, the process of making lubricene.

The works and office, which are illustrated on our title page, are located at 134 Maiden Lane, in this city. Here three principal grades of lubricants are made, which are known as Lubricene, Cylinder oil, and Engine oil. The materials used in the manufacture of these lubricants are tested and properly compounded by sample in the laboratory. The ingredients, which are common well known substances, consist of animal fats and oils, mineral and vegetable oils, caoutchouc, and an alkali.

The fat after being carefully refined is put in a melted state into the caldron seen at the upper left hand corner of the engraving; the oils, caoutchouc, and alkali are added, the whole is then subjected to a rather high but well regulated temperature for two hours, after which it is drawn off into pans, and conveyed to the cooling room shown at the lower left hand corner of the engraving. In the winter the natural temperature of the air will cool the compound with sufficient rapidity, but in warm weather the temperature is reduced by artificial means; the tables upon which the pans rest being hollow, a current of cool water is permitted to flow through. When the compound attains the required temperature, it is conveyed to the packing room, where it is removed from the pans and packed into cans or kegs, each package being weighed to insure a proper measurement of the lubricene.

The cans or pails for containing the lubricene are made in great numbers by approved machinery in the shop shown at the lower right hand corner of the engraving.

Cylinder oil, which is composed of mineral and animal oils and an alkali, is compounded in the caldron in the middle ground at the top, and is drawn directly from the caldron into barrels for shipment.

Engine oil is compounded in the larger caldron at the right. It consists of animal oil with the addition of a percentage of mineral oil.

The secret of the success of these lubricants lies in the care exercised in their manufacture, and in the peculiar combination of materials, whereby homogeneity and smoothness are secured. The engine oil is compounded with a view to the neutralization of the fatty acids, which, in the case of oils and fats not treated in this manner, are freed by the action of steam and work havoc with the valves, valve seats, piston, and cylinder.

Beside economy in the lubricant itself, Mr. Chard claims a great saving in the matter of time, as, when these lubricants are applied with a peculiar cup of his own manufacture, the friction surfaces are continuously lubricated without waste, and without the necessity of constant attention.

We are informed that these lubricants have been adopted by some of the principal railroads in the country, and that it is growing in favor wherever it is introduced.

A FLOATING ELECTRIC LIGHT.

M. de Lussex, of Belgium, has lately tried with success an electrically lighted beacon or buoy, for coast and harbor purposes, made as follows: The lantern of the buoy is provided with a Rhumkorff coil, a vacuum tube or globe. A battery composed of large zinc and carbon plates placed close together are carried on the lower part of the buoy in contact with the sea water. Wires from this battery lead to the primary circuit of the induction coil, and the secondary electric discharges appear in the vacuum tube. This apparatus yields a constant electrical light as long as the battery lasts. It is not very strong, only becomes visible at night; but the plan, it is believed, may be made useful.

Is the Subdivision of Electric Light a Fallacy?

Mr. W. H. Preece, the eminent electrician and manager of the English postal telegraph system, contributes a paper to the *Philosophical Magazine*, in which he points out that the theory of the electric light cannot be brought absolutely within the domain of quantitative mathematics, for the reason that we do not yet know the exact relationship existing between the production of heat and the emission of light with a given current. We, however, know sufficient to predicate that what is true for the production of heat is equally true for the production of light beyond certain limits. He shows that the full effect of a current can only be obtained by one lamp on a short circuit, and that when we add to the lamps by inserting more of them on the same circuit, or on a circuit so that the current is subdivided, the light emitted by each lamp is diminished in the one case by the square, and in the other case by the cube, of the number inserted. With dynamo-electric machines there is a limit which has to be reached before this law begins to act, and it is this fact that, in Mr. Preece's opinion, has led so many sanguine experimenters to anticipate the ultimate possibility of extensive subdivision of the light—a possibility which he considers hopeless, and which experiment has hitherto proved to be fallacious.

The *Textile Colorist* is the title of a new and handsome monthly publication, devoted to practical dyeing, bleaching, printing, finishing, etc., by Dr. M. Frank. $4 a year. Philadelphia, Pa.

New Inventions.

An improvement in Microscopes has been patented by Mr. Ernst Gundlach, of Rochester, N. Y This invention relates to improvements in microscopes, by which the tube is not only adjusted parallel to the supporting post, but always retained during the adjustment at equal distance therefrom, so that the position of the optical axis is not changed, but kept in line with the axis of the illuminating apparatus. The stage and object carrier are so arranged that an improved oblique illumination is permissible. The mirror and sub-stage are suspended in a novel manner.

Mr. Joseph Vacaro, of Bayou Sara, La., has patented an improved iron fence post, which is so constructed that any or all of the fence panels may be repaired or renewed without disturbing the posts.

An improved Portable Fence has been patented by Mr. C. D. A. Curry, or Stonewall, Va. This is a cheap, light, and easily arranged fence that can be readily transported from one place to another, and set up and accommodated to the inequalities of the ground.

Mr. Robert Dillon, Jr., of New York city, has patented a simple and effective Device for Attachment to the rear part of the lower ends of Pantaloons Legs in wet weather, to prevent the mud from being rubbed upon the pantaloons legs and upon the rear parts of the boots in walking.

Mr. Solomon Zemansky, of Brooklyn, N. Y., has patented an ornamental and convenient Box adapted for holding or displaying small articles of sale, and forming a convenient package for sale, and of itself an article of ornament.

Mr. Richard E. Rye, of Mount Pleasant, Mich., has devised an improvement in the class of Clothes Driers having a revolving part, which is vertically adjustable on the pivot post, and to which a cord is applied for suspending the clothes.

Mr. Napoleon W. Williames, of Philadelphia, Pa has patented an improved Process for Bronzing Metals, which consists in first coating the object with paraffine varnish to close up the holes, make a smooth surface, and stop oxidation, then covering the varnished surface with plumbago, to render it conductive, and finally depositing upon said surface of plumbago a coating of the required metal by galvanic action.

Mr. Thomas F. Longaker, of West Philadelphia, Pa., has patented an improved device for Attachment to Faucets for measuring liquids as they are drawn from a can or cask. It is simple, convenient, and accurate, and will prevent the liquid from being spilled and will not allow its odor to escape into the room.

Mr. George H. Hayden, of Boston, Mass., has patented an improved Cigarette Machine, in which the paper tube is formed, the tobacco packed therein, the ends of the tube turned down, and the cigarette completely finished by one passage through the machine.

Mr. William J. Doyle, of Chicago, Ill., has patented an improved Spool Holder, in which an ornamental base supports a vertical rod fitted to revolve upon the base, and the rod carries three leaves, that are each formed with a series of horizontally projecting points, which sustain the spools by means of nipples formed on the points. At the upper end of the rod is an urn formed with barbs for retaining a pincushion. The parts are made of sheet metal.

Messrs. Francis W. Allen & Daniel Crane, of Saginaw, Mich., have patented an improved tool which they call "The Inspector's Pencil," It is especially designed for inspectors' use for marking rough lumber.

An improvement in Lamp Burners has been patented by Mr. Joseph A. Talpey, of Somerville, Mass. This invention consists in providing the flat wick tube of an oil lamp with a taper or small wick tube, which is so placed in the flat tube as to divide it into two equal parts. When the lamp is to be used for the night, the larger wicks are turned down, the taper wick continuing then to burn and to keep up a small flame for the night.

Mr. William Haas, of Lyndon, Kansas, has patented an improved Washing Machine which is an improvement on the machine for which letters patent No. 203,031 were granted to the same inventor April 30, 1878.

A NOVEL RAILWAY TRACK.

The problem of reducing the noise and vibration of the elevated railroads, which has engaged the attention of scientific experts for many months past, seems to be finally solved by an ingenious and very simple invention, just patented, and is being brought to the attention of capitalists as well as the general public.

The inventor introduces beneath each rail a series of longitudinal springs, each composed of six layers of Georgia pine or white ash, 9 inches wide and 1 inch in thickness. There is a central support, or safety check, from which the lower layers of the spring diverge at an upward angle until their ends rest upon the ties at the end of the rail. A curved spring, composed of four or more layers of pine or ash, passes over the top of the central safety check, with its ends resting midway upon the lower spring. The rail, 30 feet long, is laid over all, its center only touching the surface of the upper curved spring. By this combination the spring is constantly yielding and recovering, or readjusting itself, as the cars pass over it. The great length of the arc described by the curve of the central spring, it is claimed, makes the vibration of the cars so slight as to be quite imperceptible.

The safety check or support, immediately under the center of the curved spring, allows a certain amount of pressure upon the spring and no more, thus preventing too great a strain on the spring should the road be used for the conveyance of heavy freight. As there are but two ties and the safety check in every section of 30 feet, light and ventilation are secured to the ground floors of stores and dwellings on the line of the road; and in winter less snow and ice accumulate upon the track. The inclination of the spring also gives opportunity for the construction of gutters or troughs to conduct the oil-drippings, rain, and melted snow into the pillars supporting the structure, and thence to the ground, thus preventing another nuisance of which pedestrians complain.

The absence of the immense number of ties now in use on the present elevated railroads, and which act as a sounding board, will in itself be a large saving of expense and will reduce the noise and vibration to a minimum.

The material used in the combination is not affected by temperature or moisture. It has been discovered by careful experiment that wood is greatly superior to iron, steel, or rubber for this purpose. Georgia pine is regarded as the best, when well covered with raw linseed oil; and the next best is white mountain ash.

This invention is applicable not only to the elevated roads, but also to the construction of suspension bridges, all kinds of railroad bridges, trestlework over marshes, low ground, and elevations, and other works requiring a combination of solidity and smoothness.

Fig. 1

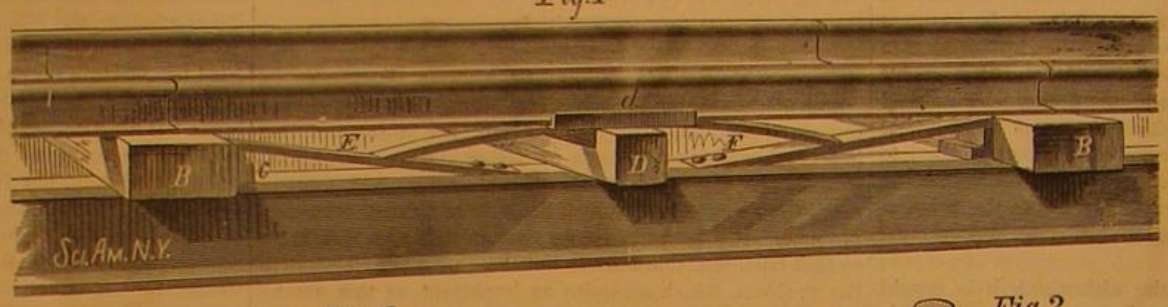


Fig. 2

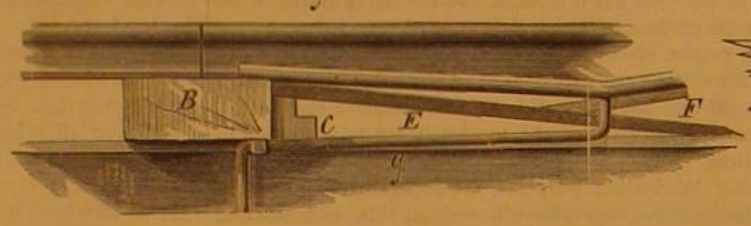
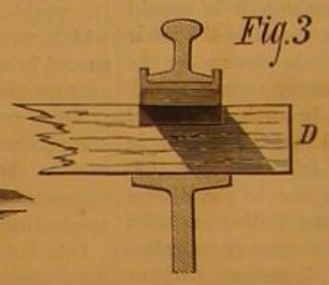


Fig. 3



HALL'S IMPROVEMENT IN RAILWAY TRACKS.

The two rails forming the track are secured at the ends to the crossties, B, which rest on the girders, C, and which in turn are supported by posts. The semi-elliptic wooden spring, F, has attached to it a chair for supporting the middle of the rail, and its ends are sustained by wooden springs, E, that rest upon blocks, *c*, and are riveted to the girders. A beam, D, is laid across the girders under the middle of the rails, and is rabbeted to receive a rubber cushion, which supports the center of the spring, F, when it is subjected to undue pressure.

To prevent oil or water dripping from the rail to the ground a gutter, shown in Fig. 3, is provided. For further information address Wm. H. Hall, 111 Nassau street, New York city.

THE Thames Embankment, London, is now lighted by electric lamps.

AN IMPROVED TYPE WRITER.

In this machine the type, D, are carried by the table, A, which is rotated by a bevel pinion meshing into the wheel, B, attached to its periphery. The pinion is turned by the wheel shown at the rear of the machine, and when the required letter comes under the follower, *d*, the latter is depressed, forcing the type downward until it strikes the paper on the platform over which the machine travels, being moved forward by the pinions, G, which mesh into racks in the base.

When the follower is relieved of pressure, are tractile spring returns the type to its place in the table, and the follower regains its normal position.

The type are inked by the rollers, E, which are supported by a crosspiece attached to the standard, A'. These rollers receive their ink from the under surface of the table, A, and apply it to the faces of the type as the table is revolved. When it is desirable to move the table without inking the type the standard, A', is pressed downward so as to remove the ink rollers from the under face of the table, A.

The upper surface of the wheel, B, is lettered to correspond with the type carried by the table.

This machine is so compact that it may be carried in the pocket, and it possesses the advantage of great simplicity.

This invention was recently patented by Mr. Jean A. Hitter, Jr., of St. Martinsville, La., from whom further information may be obtained.

Fig. 1

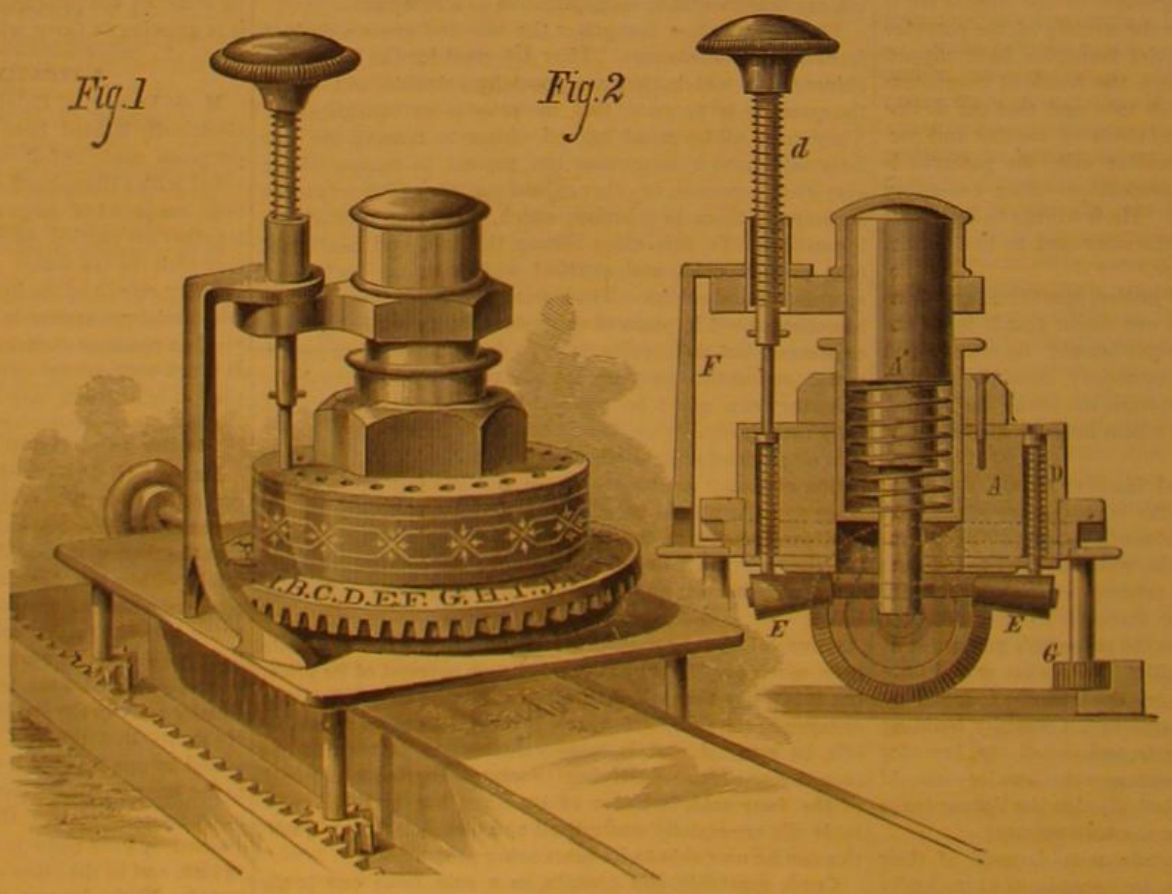


Fig. 2

HITTER'S TYPE WRITER.

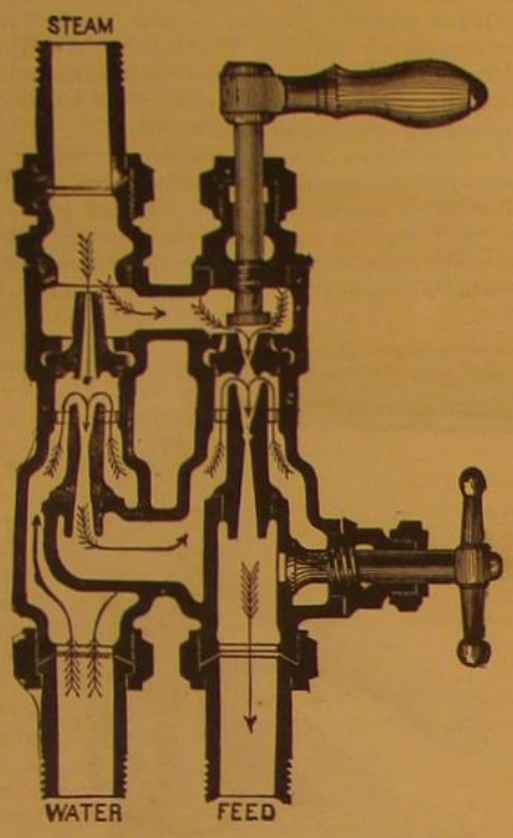
THE cabinet work of the new Cunard steamer Gallia is to be in the Japanese style, and is now being manufactured in Japan. It is claimed that she will be the model steamer of the Atlantic ocean. Her estimated cost is $850,000. It is expected that her first trip will be made in July.

THE HANCOCK INSPIRATOR

One of the recent contributions to hydraulic engineering—and one which promises to be of great value to all users of steam—is the "inspirator," so called, an invention patented by John T Hancock, of Boston.

The inspirator is a compound steam jet apparatus, for raising and forcing water, designed to do the work ordinarily accomplished by pumps and injectors, with greater economy and regularity than has yet been possible with these machines.

The Hancock inspirator consists of a combination of two sets of apparatus, contained each in a separate chamber, one being employed for lifting water from a well or other



LONGITUDINAL SECTION OF HANCOCK INSPIRATOR.

source of supply, and conveying the same to the second apparatus, which transmits it to the boiler, or forces it against a greater pressure than that of the impelling steam. The lifting apparatus raises water more than 25 feet, and can be used independently of the forcing apparatus, for raising water to a moderate height, thus supplying the place of a suction pump or a steam jet pump.

The sectional view shows the simplicity of construction which characterizes the inspirator. The illustration represents the form used on stationary boilers. Steam enters through the pipe marked STEAM, the water from the well is drawn through the pipe marked WATER, and the condensed steam and water issue through the pipe marked FEED.

The apparatus on the left in the engraving is for lifting, that on the right for forcing. No adjustment is necessary for varying steam pressures, but the quantity and temperature of the water can be varied by increasing or reducing the quantity of steam or water supply.

For locomotives the form of the inspirator is somewhat modified, but the principle is the same.

The continuity of the jet of steam and water never being broken by the jar of a locomotive passing over switches and frogs, the inspirator is a more reliable feeder than a pump. Is not appreciably affected by wear, nor is its action liable to be stopped by sediment in the water.

On locomotives the lifting apparatus serves an important purpose as a regulating device, making this instrument more sure and positive in its action.

We are informed that although the inspirator has been but a comparatively short time before the public, a large number of them (over 4,000) are now use, and that they have thus far given general satisfaction.

Many advantages over a pump are claimed for it as it needs no packing, it is not noisy, and it can be adjusted to feed the boiler continuously, which is acknowledged by all engineers to be the best and most economical method of feeding.

The inspirator is manufactured by the Hancock Inspirator Company, office 52 Central Wharf, Boston, Mass.

Houses for Workingmen.

The Chicago *Tribune* mentions a building scheme which the Union Mutual Life Insurance Company propose to carry out upon some of their vacant property in the southern part of Chicago. The plans are the work of Messrs. Wheelock & Clay. The problem of building houses in a continuous block, and yet having, to a great degree, the appearance of isolation, is accomplished by a double court in front between each pair of houses; this feature, besides giving ample light and ventilation to all inner rooms, affords the architects an opportunity of displaying considerable variety in the treatment of their designs, not only of the exterior, but of the interior. The courts in the rear are quite similar to those in front, leaving only a short line of party wall between the two houses. As the courts are thus in pairs, they give double the amount of light, and yet the windows are so arranged that it is impossible to see from one into any other. Also, by an ingenious arrangement of the staircase in each alternate house, the front entrances are entirely separate and come in regular succession.

These houses are to be of two stories, with cellar and attic; in the cellar are the laundry, furnace room, storerooms, etc. Each house has a parlor, hall, and staircase hall, dining room, kitchen, etc., upon the first floor; part of them have a library in addition, all well lighted and ventilated. The main stairs are at the rear of the parlor, and not exposed to view upon entering or leaving the entrance halls, which are to have tile floors, open and unobstructed.

A NEW CHECK ROW CORN PLANTER AND DRILL.

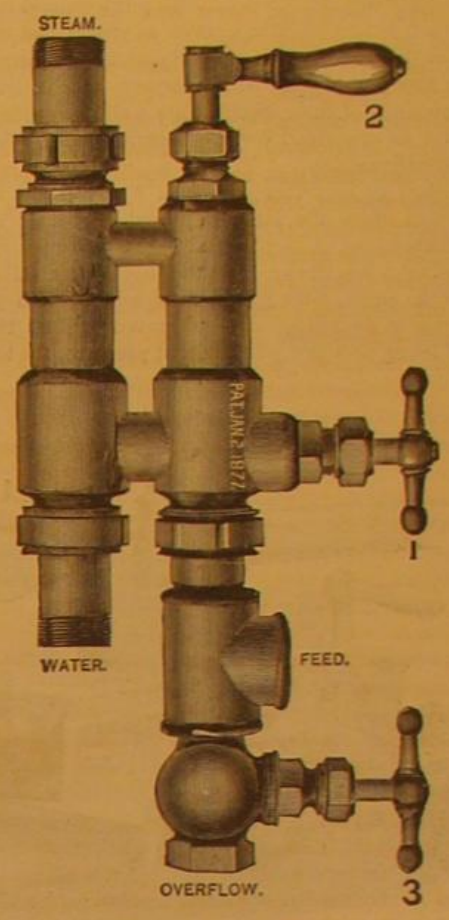
The accompanying engraving shows a new agricultural implement recently patented by Mr. Osman C. Du Souchet, of Alexandria, Mo. It is designed for planting corn in accurate check rows, and it is constructed so that all parts of its mechanism are under the control of the driver. The working parts of the machine are supported by wheels having a very broad tread, and by hollow standards, A, connected with the runners or plows, B. Seed boxes, S, are mounted on a frame that is jointed to another frame connected directly with the axle, and the seed valves are operated by a common bar that is connected with a lever, G, which is actuated by two cam lugs, F, placed on opposite sides of the axle. These lugs strike opposite sides of the beveled end of the lever, G, in alternation, and thus impart to the lever and to the seed valves a reciprocating motion. A section of the axle bearing the cam lugs is shown in Fig. 2.

The frame that carries the runners and seed boxes may be raised or lowered by moving the lever, J, and it may be maintained in a raised position by means of a latch, shown at the rear of the seat. The lever, C, is supported by a slide, which is moved by the lever, L, so as to throw the lever into and out of engagement with the cam lugs on the axle.

At one side of the machine there is upon the axle a spur wheel, which may be turned by the lever at the left of the seat whenever it is desired to change the relative position of the cam lugs on the axle. To admit of this adjustment the drive wheels are connected with the axle by pawls and ratchets. As the machine moves forward the runner, B, makes a furrow, into which the seed is dropped through the hollow standards, A. The wheels, having a wide tread, follow the runners and cover the seed.

California Raisins.

About four years ago Mr. J. P. Whitney, a gentleman widely known in California in connection with wool growing and grain raising on a large scale, began planting vines of the "Muscat of Alexandria" variety of white grapes, with a view to demonstrating that raisins can be made in America of as good a quality as those from abroad. Since that time about 200,000 vines have been planted. As the first result of Mr Whitney's experiment two car loads of 20,000 lbs. each of California-made raisins were recently sent East, one car load coming to New York city, and the other going to Boston. The New York *Times* reports that in both cities they have been received with favor, selling equally well with the best imported Malaga raisins, with which they compare favorably as to size, color, skin, stones, and flavor—the latter being the most essential quality. The United States is the greatest raisin-consuming country in the world, and uses annually more raisins than the whole of Europe. The market is mainly supplied from Spain, the raisins known as "Ma-



HANCOCK INSPIRATOR.

lagas" being considered the best. They come from a comparatively narrow strip of country in the south of Spain, which has hitherto been regarded as surpassing all other regions for raisins of that character. The annual yield of Malaga grapes averages 2,250,000 boxes of 20 lbs. each. It sometimes reaches 2,500,000 boxes, and last season about 2,000,000 boxes were marketed. Of this enormous yield the United States takes fully one half, on which it pays a duty—as on all other raisins—of 2½ cents per lb.

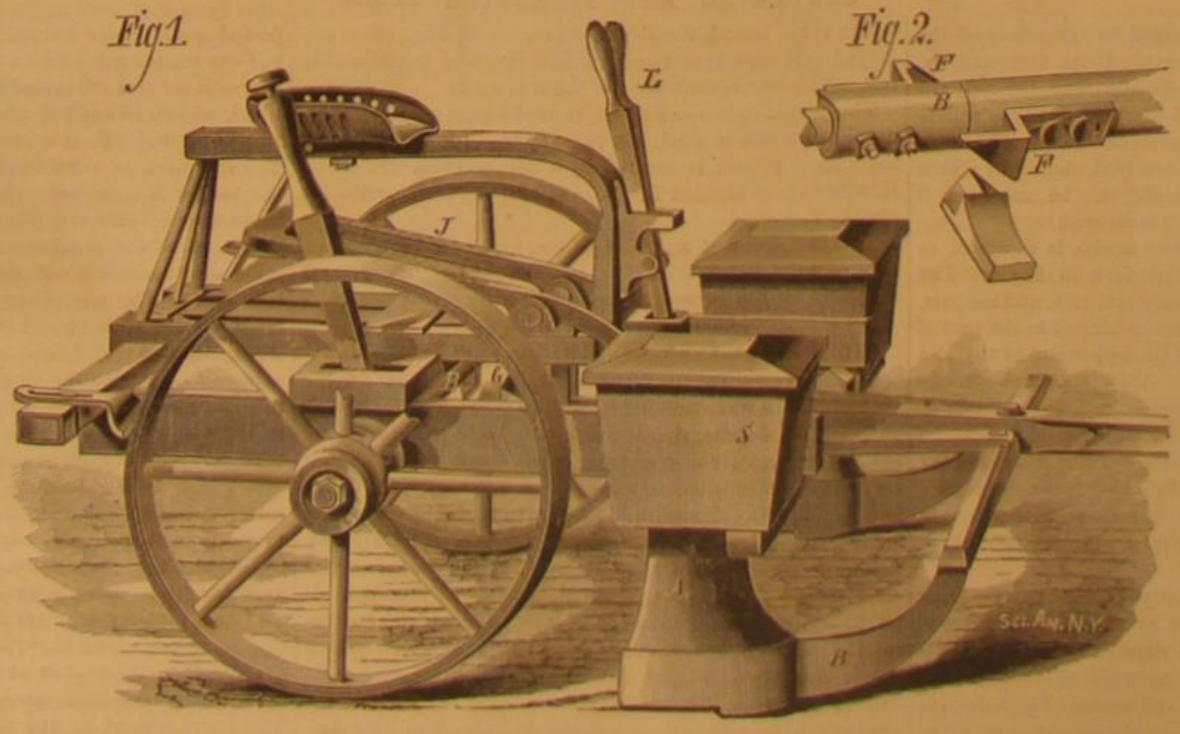
The American raisins are made from a white grape, the "Muscat of Alexandria," to the raising of which the soil and climate of a large portion of California are well adapted. The vine begins to bear somewhat in the second year, although the full bearing capacity is not developed until it is five years old, and continues to bear for about half a century, and sometimes for 75 years. In the cultivation of raisin grapes American grape growers have little to learn from Spain, but in the curing and packing of the raisins a lack of experience is still felt.

The raisins are not cured by any artificial process, however, but in a comparatively simple manner. The grapes are laid on gravel beds, and are exposed to the sun for ten or twelve days in August or September, when they are ready for packing, having turned from white to brown, and gradually changed to the familiar dark color of the raisins of commerce. The white sugar which is generally found attached to the raisins sold in the market is entirely a natural product of the grape, and comes on with age, first appearing, as a rule, when the raisins are about two years old. The packing, however, is an operation which requires great care. To properly pack a single 20 lb. box the entire time of one man is needed for a day and a half, so careful is the manipulation of the raisin bunches, while at least as much time is required to select and pick over the bunches before packing. Mr. Whitney believes, however, that raisins can be cured in California fully equal to the Malaga or any other raisin.

The chief difficulty with which the California raisin raiser will have to contend

Fig. 1.

Fig. 2.



DU SOUCHET'S CHECK ROW CORN PLANTER AND DRILL.

in the effort to compete with foreign raisins is the cost of labor. The Spanish vineyardists can get all the laborers they need for from 15 to 25 cents per day, while the California producers must pay at least $1 per day. The very much greater productiveness of the soil, however, will do much to offset this disadvantage.

AMATEUR MECHANICS.

CENTERING AND STEADYING.

To center a cylindrical piece of metal readily and accurately is a very simple matter when the workman is provided with tools especially designed for the purpose, and it is not difficult when an engine lathe or even an engine rest is available; but to do it easily and properly in an ordinary plain foot lathe may puzzle some of the amateur mechanicians.

Although some of these methods are well known they will nevertheless be described for the benefit of some who may require the information.

The method of centering shown in Fig. 1 is one of the most common where the lathe is provided with an engine rest. A forked tool, A, is clamped in the tool post in such a position that a line drawn from the point of the tail center will bisect the angle of the fork. A square pointed center, G, is inserted in the tail spindle and moved against the end of the rod being centered with a slight pressure, the tool, A, being at the same time moved forward by the screw of the engine rest until the rod turns smoothly in the fork and the square pointed center has found the center of the rod; the tail spindle is then moved forward until the cavity is sufficiently deep to permit of starting the center drill. The angle of square center, G, for very hard material, should be a little more obtuse than that shown in Fig. 4. In any case, it should be of good material and well tempered.

In Fig 2 is shown a centering tool which is designed to take the place of the engine rest and fork in Fig. 1. The part B is fitted in place of the ordinary tool rest, and the jaw, C, which has in it a V-shaped notch, is hinged to the part B at D. A screw, E, passes through the upper end of the part B, and bears against the jaw, C. After what has already been said in connection with the engine rest, the manner of using this contrivance will be readily understood.

In Fig. 3 the hand tool, F, is employed for steadying the shaft and bringing it to a center. This tool is bent to form a right-angled notch for receiving the shaft, and when in use it is supported by the tool rest after the manner of an ordinary hand turning tool.

Work that is too large to be readily centered in this manner is often centered approximately by means of the universal square, as shown in Fig. 5. A diametrical line is drawn along the tongue of the square, the work is then turned through a quarter of a revolution, and another line is drawn. The intersection of these lines will be the center, at least approximately.

This point may now be marked with a center punch, and the work may be tested in a lathe. If it is found to revolve truly on the centers it may be drilled, otherwise the center must be corrected with the center punch, and the work again tested in the lathe.

After centering by any of these methods, the center must be drilled and countersunk with a suitable tool, so that it will fit the lathe center, as shown in Fig. 6. The angle of the lathe centers should be sixty degrees. To insure uniformity in everything pertaining to the centers, the center gauge, shown in Fig. 7, should be used for getting the required angle on the lathe centers and on the drills used in centering.

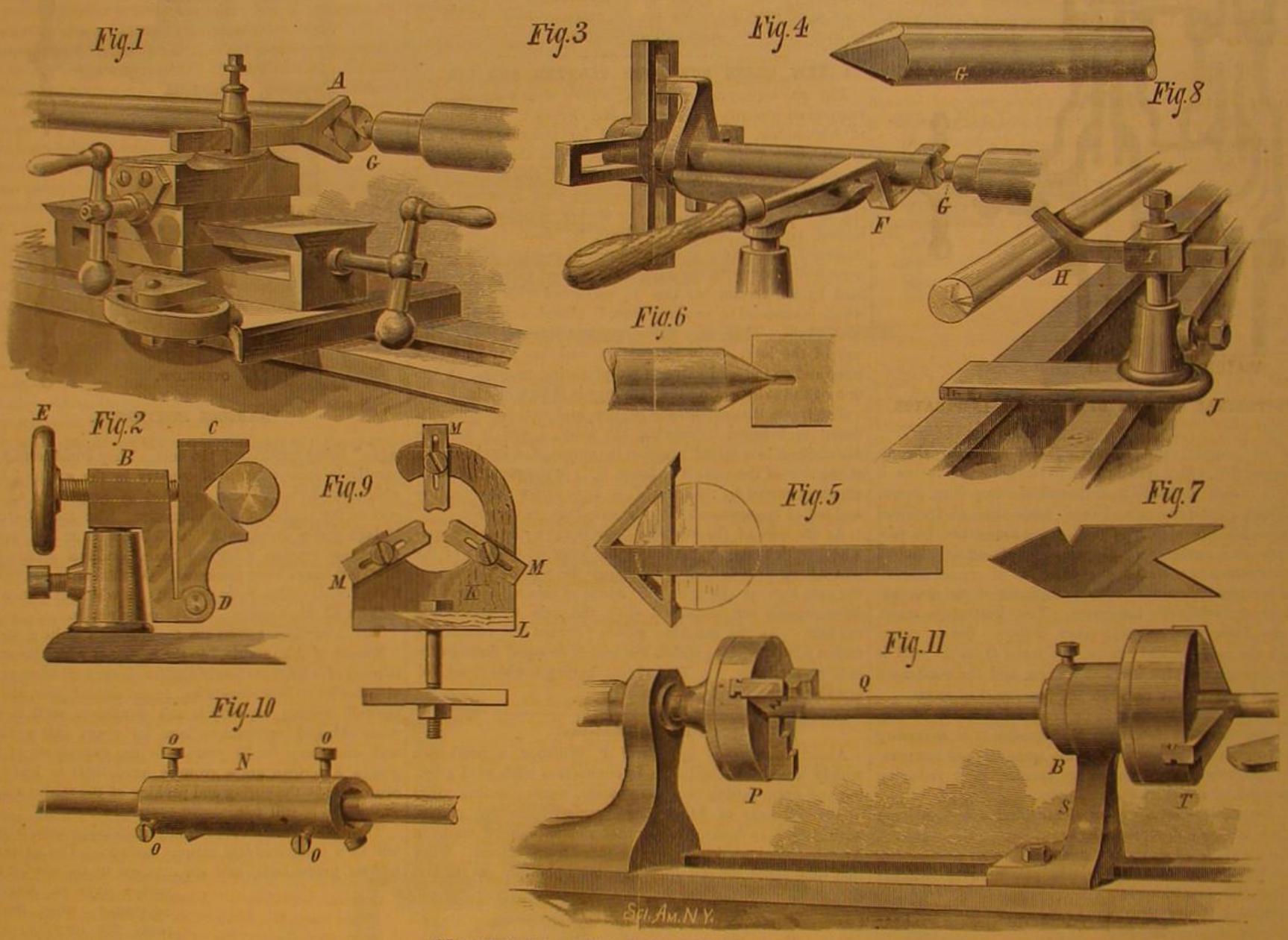
The matter of steadying long, slender rods while being turned in the lathe is often perplexing.

In some cases it may be done tolerably well in the manner illustrated in Fig. 8. The fork, H, is supported by the standard, I, which is inserted in the socket of the rest support, J. The device shown in Fig. 2, may be used in a similar way.

Fig. 9, represents a steady rest, the construction of which will hardly need explanation. For light work it may be made of wood; the upright being secured to the cross piece, L, which rests upon the lathe bed. The slotted pieces, M, are adjustable lengthwise to accommodate the size and position of the shaft. When it is required to support a bar which is not round, the sleeve, N, shown in Fig. 10, is employed. It slips over the shaft and revolves in the steady rest. The bar is centered by the screws, O.

The device shown in Fig. 11, is used where a hollow mandrel lathe is not at hand. A piece of gas pipe, Q, is held by the chuck, P, and is secured by a set screw in the sleeve, B, which is journaled in the standard, S, and carries the chuck, T.

This arrangement may also be employed for turning the ends of long rods where it is not desirable to put them regularly on the centers of the lathe. M.



CENTERING AND STEADYING TOOLS.

THE MANUFACTURE OF SEWING AND FLOSS SILK.

Twenty years ago the manufacture of silk goods in the United States was confined to so few firms and limited to such small amounts, that it was hardly to be classed among the industries of the country. Since about 1860 we have been brought into closer commercial relations with China and Japan, and other silk producing countries of the world, which has given silk manufacture a powerful impetus. American manufacturers discovered that their goods could rival those of European production in quality as well as price, and consumers found it to their advantage to patronize the home industry. Statistics could be given which would show the immense increase of American silk stuffs and the corresponding decrease of imported silks, but as the purpose of this article is to describe the process of manufacturing, they must be omitted.

The raw silk is imported in bales, each containing twenty bundles or "books." These weigh from five to eight pounds each, and are made up of a number of skeins. They are broken open and the skeins assorted according to the fineness of fiber; this is done entirely by touch and very rapidly. Ordinary grades of silk contain three sizes; the finer qualities only two. The fiber is exceedingly fine, translucent, of a white or yellow color, and very tough.

After the skeins are sorted they are soaked for three hours in a tank of soap and hot water, to remove the natural gum and the adulterating substances which are added to increase the weight. This adulteration is sometimes equal to one fourth of the entire weight. The silk is dried in a centrifugal drier without rinsing, as it is found that the presence of a small quantity of soap facilitates the handling of the material. It now goes to the reeling machine. Each of these contains thirty spools and reels. The skeins are placed upon the latter and rapidly spooled. Each machine has a single attendant who, after long practice, shows wonderful dexterity in untangling and tying the delicate fiber.

To a casual observer, raw silk appears to be regular and to possess a perfectly smooth surface; this is, however, not the case; it is uneven and contains many scales and projecting lumps, which must be removed before the silk can be twisted. This important process of cleaning consists simply in running the fiber through a pair of sharp and nicely adjusted semicircular knives. It is now ready to be combined to form the thread. Three or more fibers, the number varying with the size of thread desired, are reeled together on a spool, which, in another machine, is rapidly revolved as the silk is wound off; this process twists it loosely together. The operation of combining and twisting is repeated, and the thread is now made, though several processes are still necessary to finish it. The first of these is stretching, an operation which elongates and tightens the twist, at the same time squeezing out the soap, which had been left till this stage. The stretching machine consists of a pair of large wooden rolls placed over a tank of pure water. The silk is wet and reeled from one to the other.

It now undergoes the most delicate operation in the entire process of manufacture—that of dyeing. Those who delight in artistically combining the soft tints of floss silk into beautiful embroideries, little think of the wonderful skill and care which is necessary to produce those tints. Primary colors must be combined, the most delicate shades must be perfectly matched, and the faultless gradations of color, which blend so harmoniously in the same skein, must be most carefully chosen with reference to the general effect. The beautiful anilines are largely used, and the skeins of silk, hung upon long wooden rods, are suspended in the hot dye. A large amount of the liquid is next extracted in the centrifugal drier, and the remainder in the drying room. The dye contained in the thread makes it stiff and harsh, and to restore its natural softness and pliability it must be "wrung." A sturdy operative hangs the skein upon a

strong projecting bar of lignum vitæ, inserts a similar bar and twists the thread, turning it until all parts have been subjected to the strain.

After picking out the loose bits it is wound on large spools, and is now ready for the spooling room. The spool, already labeled by a method which will be described hereafter, is placed on a spindle, the thread wound on a few turns, and it is then set in rapid revolution. As the silk runs on the spool it passes through a guide in the end of a sliding arm, which is moved regularly back and forth by a revolving screw; this screw has the same pitch as the tightly wound thread upon the spool, due allowance being made for the difference in speeds, and the silk is consequently run on with unfailing accuracy and smoothness. When filled the spool is stopped and the thread cut and fastened. The entire operation takes but a few seconds. The spools are now weighed separately, and also in lots of one dozen, in order to correct any inaccuracy in amount. All that remains is to place them in neat paper boxes, and they are ready for shipping.

The larger part of the spools used are labeled by stamping directly on their ends, in one or more colors. This, besides causing a large saving in expense over the paper label, insures the preservation of the label. The spools are fed between a pair of inked metal rolls with reversed dies upon them, which print the design a sixty-fourth of an inch below the surface. When two colors are used a second pair of rolls become necessary.

Galileo's Museum, Florence.

In the January number of the *Pharmacist and Chemist*, published by the Chicago College of Pharmacy, we find an interesting letter from H. D. Garrison, Florence, Italy, describing incidents in the life of Galileo, which we are sure will be read with interest by many, and by those especially who have visited Florence and Pisa, which are the central cities of the physical sciences of Europe, and have seen the trophies of Galileo so carefully preserved there, and which the writer describes in connection with incidents in the life of their author. The extracts we give cannot help but revive pleasant memories. It will be remembered that not only Galileo, but Leonardo da Vinci, the philosopher, artist, and statesman, the renowned Torricelli, Michael Angelo, the painter, sculptor, architect, civil and military engineer, and diplomatist, and the powerful Medici family, honored Florence by making it the arena of their most memorable exploits in scientific research. Truly, says the writer, this is classic ground. Having been the home of Galileo during the principal part of his eventful life, this city is possessed of surpassing interest to those scientifically inclined. This great philosopher was born in a very humble, not to say hard looking, two story stone house, situated on a little crooked street in the old city of Pisa, located about sixty-five miles west of here, near the mouth of the Arno.

When young Galileo attended church, instead of looking at the saints and crucifixes or even at the pretty girls, he watched the swinging chandelier and reinvented the pendulum clock. No wonder he watched this chandelier, for it is a remarkable one, from the fact that the rope by which it is suspended is about one hundred feet long. I gave the chandelier a push, as any rather tall person may do, and during my stay in the cathedral it continued to vibrate without apparent retardation. He observed, what few will now admit without the demonstration, that the vibrations of a pendulum, whether large or small, are performed in equal times. While quite young, Galileo arrived at the conclusion that large and small bodies fall with equal velocity. To the learned men of Pisa, chiefly priests, this doctrine appeared extremely absurd. To test it, an experiment was performed by dropping bodies of different sizes from the famous leaning tower, 180 feet high. To the utter astonishment and discomfiture of Galileo's opponents, the bodies, large and small, projected simultaneously, kept close company until at the same instant all reached the earth. On account of these experiments Galileo was compelled to leave Pisa, and took refuge in the rival city, Florence.

At the latter city, called throughout Italy "Firenze," Galileo, quite unmolested, busied himself in the study of mathematics, physics, and chemistry until the year 1610, when, having heard that a Dutchman, Lippershey, had constructed a telescope, he, without having seen it, contrived and manufactured one for himself of such power that he was enabled to count forty stars in the constellation of Pleiades, where before but seven had been seen. The mountains of the moon were discerned, the phases of Venus recognized, and the satellites of Jupiter discovered in quick succession. Thus, in a few months, the doctrine of Copernicus, then regarded as heretical in the highest degree, was completely confirmed. But the Church, then unused to reverses, and unskilled in explaining away scientific contradictions, saw no way to meet the issue successfully but by physical force. The priests were directed to oppose the doctrine, and did so at once from every pulpit in Florence. The arguments used by them generally ran about as follows:

All things were made for man, and nothing was made in vain. But the satellites of Jupiter, not being visible, are useless, and therefore do not exist. Galileo was promptly arrested on the charge, then a fearful indictment, of heresy. In vain did the old philosopher explain and beg them to look for themselves. His adversaries, well illustrating the adage that "none are so blind as those who will not see," would listen to nothing but renunciation and denial of the alleged discoveries, presenting at the same time the alternative of indefinite imprisonment, probably ending in death.

Remembering the fate of the beautiful Athenian woman, Hypatia, who was torn into shreds by the monks under St. Cyril at Alexandria, for teaching the heretical philosophy of Plato and mathematics; and remembering also the fate of poor Bruno, who but a little while before had been driven from England, Germany, and Switzerland, in succession, and who, having taken refuge in Venice, was there kept in solitary confinement six years, then removed to Rome and kept two years longer in a dungeon, and finally slowly burnt to death, so slowly that he begged for more wood, or any means to end his suffering—and all this for having simply *argued* in favor of the probability of the Copernican doctrine, Galileo, concluded, very wisely, to appease the wrath of the Inquisition by the required denial. The Vatican Council supplemented this trial by formally denouncing the Copernican theory of the universe as "false, and utterly at variance with the Holy Scriptures."

Several years later, under the reign of a new pope, whom Galileo thought more liberal and generous, he ventured again to publish his discoveries and opinions, and was again promptly arrested and tried by the Inquisition for heresy. Again a public denial was required as a condition for mitigating his sentence, and again Galileo consented to make it. This time, besides his denial before the pope and Inquisition, he was required to publicly renounce the doctrine and deny his discoveries before his friends in the Santa Croce Cathedral of Florence.

Lest his friends should not all attend and profit by his recantation, they were compelled to be present. Then on bended knee, after kissing the Bible, he solemnly pronounced himself a liar and dupe, but on departing, as tradition has it, whispered to one of his friends, "nevertheless it (the earth) moves." Not content with this the Church felt bound to inflict mild, exemplary punishment, and hence detained him as a prisoner for life. Although his prison was his own house at Arcetri, a few miles out of Florence, still he was not permitted to leave it, even to attend church or to secure medical advice at Florence, nor was he even permitted to see his friends until after he became blind, when this permission was graciously accorded him.

At his death he was refused burial in consecrated ground, and his right to make a will was disputed. Now, in the same old cathedral which witnessed his public recantation, stands an elegant marble tomb, erected to his memory by his favorite pupil, Giovanni, and ever and anon the priests declaim, in glittering generalities, of the wonderful support their doctrines received from astronomy!

In the Natural History Museum, a beautiful room called the "Tribuna de Galileo," covered by a dome elegantly frescoed with scenes illustrative of his checkered life, is devoted to the exhibition of a magnificent statue of the old philosopher, his telescope and other philosophical instruments.

The telescope is astonishingly small and simple. It consists of an ash-gray colored tube, about four feet nine inches long, by two inches in diameter. The object glass, now cracked and shown separately, mounted in brass, is about 1¼ inches in diameter. The eye-glass, apparently a simple plano-convex lens, about three quarters inch diameter, is still *in situ*, apparently mounted in a wax like cement. The whole instrument being in a locked glass case, placed in a niche about ten feet above the floor, I was unable to make more accurate measurements. By the side of the telescope is shown another instrument of similar form and size, with which he at a later period discovered the spots on the sun. He also invented several other instruments, as a goniometer, dynamometer, and various mathematical instruments. He also invented the compound microscope, the original instrument made by him being still preserved in the old stone tower situated on a hill overlooking the city of Florence and valley of the Arno river, where he made his celebrated discoveries in astronomy. This instrument consists of a wooden tube about eight inches long, having small convex lenses about one quarter inch diameter, for both object and eye glasses. These were mounted in hard wax. The eye-glass was capable of slight adjustment, by being set in a wooden cap, which was screwed upon the wooden tube. The stage was simply a slip of glass, but it was illuminated by a little mirror placed below it, precisely as may be seen in our cheap microscopes. I wanted very much to peep through the microscope, and also through the telescope, but saw no possible means of doing so. The tower used by Galileo was apparently an old castle or watch tower used by the Florentines in their perpetual wars with adjoining provinces, during the two or three preceding centuries. Near the top of the tower is a square room which Galileo used as his studio and laboratory. It is said to appear now just as when used by the great master, from which I judge that he was not very fastidious.

PATENTS are now printed and prepared for issue so that they may be mailed on the day of issue, thereby bringing the patentee into possession of his patent some two weeks earlier than under the old rule. Owing to this change, there will be no patent lists bearing date Dec. 24 and Dec. 31, 1878; the list following that of December 17th is that of Jan. 7, 1879, which appears in the present number of this journal.

WE are indebted to Mr. Lewis J. Miller, Clerk of the Albany, N. Y., Fire Department, for a copy of the annual report.

Correspondence.

Isolation by Gutta Percha.

To the Editor of the Scientific American:

With reference to the artice "Isolation by Gutta Percha," in No. 25 (December 21, 1878), a few words may not be out of place, though they come from a different quarter.

The writer of the article mentioned breaks a lance for the late lamented Paymaster U.S.A., Mr. Simpson, and exhibits undoubtedly great zeal for his protégé, but the facts hereafter to be stated will probably set at rest the doubts in regard to the priority of the invention, as far as Mr. Simpson is concerned.

"Gutta percha was first imported," our informant says, "from the East Indies into England in 1845." According to all available sources, the best of which shall be immediately named, the first importation of that article was effected by the assistant surgeon, Dr. Montgommerie (or Montgomery, as some have it), from Singapore, in 1843. *Vide* Moigno, "Traité de Télégraphie Electrique," 2d ed., Paris, 1852, p. 294; Du Moncel, "Exposé," 3d ed., 2, 456; *Dingler's Journal*, 97, 237; "The Atlantic Telegraph," London, 1866, p. 108; Poggendorff, *Annalen*, 74, 157. The *Mechanics' Magazine*, 1847, 46, 474, gives the name of the first importer of gutta percha as Joze d'Almerida, but agrees about the year with the rest of the authorities enumerated above.

Our informant further says "that the first publication in England regarding the isolating qualities of gutta percha was made in March, 1848, by Professor Faraday."

Now there is but a slight mistake in this, but a mistake it certainly is. In citing dates one should be scrupulously exact. That first publication took place on the 9th of February, 1848, full one year and a half after the discovery of the isolating qualities of gutta percha was made by a Prussian officer, who since is ranked among the first telegraph engineers of the age. Werner Siemens, then lieutenant of Prussian artillery, had been trying since the fall of 1846 to isolate subterranean wires by gutta percha. In the spring of 1847 he had succeeded so far as to be able to lay before the Board of Commissioners, convened for the purpose of establishing telegraph lines in Prussia, the project of isolating subterranean wires by gutta percha. The Commissioners, well aware of the advantages which subterranean lines presented over those of any other kind, did not hesitate to have two such lines laid, both of which were executed by Siemens in the summer of 1847.

The correctness of this statement may be ascertained by the perusal of the *Philosophical Magazine*, 3d series, 32, 165; of the *Journal of the Society of Telegraph Engineers*, vol. 5, London, 1876, p. 82; and of the *Telegraphic Journal*, 4, 106.

It appears from all this that when Mr. Simpson, in his application to the Patent Office, November 22d, 1847, claimed the isolation of telegraph wires by gutta percha as his invention, he was rather behindhand, and Mr. Siemens had had considerably the start of him.

It may as well be added that Mr. Siemens, together with his partner and co-operator, Mr. Halske, constructed, as early as 1847, the first press by the means of which the telegraph wires were enveloped by the gutta percha, the envelope not showing any longitudinal seam.

It is indeed surprising that Mr. Simpson's name is nowhere mentioned as having had anything to do with the isolation of wires by gutta percha, as it is a well known fact, even on this side of the Atlantic, that Samuel T. Armstrong established at Brooklyn, in the year 1847, a manufactory "of gutta percha for the isolation of telegraph wires," and that the experiment made in 1848 to lay a wire isolated by gutta percha through the Hudson river met with such a signal success that Armstrong, elated by that event, proposed the laying of a gutta percha cable between Europe and America. (Shaffner's "Telegraph Manual," p. 254.)

Where was Mr. Simpson at that time, and why did not he step forth and assert his rights?

We, therefore, cannot accede to our informant's opinion, that Mr. Simpson's rights have been impaired through a misconception of the duties of the Patent Commissioner, but are led to believe that the Patent Commissioner concerned was rather cautious about issuing a patent, and judiciously refused what, to the best of his knowledge and belief, he could not grant.

Even the favorable report of Congress, in 1862, "on the originality and novelty of Mr. Simpson's invention," and the patent granted him rather late in 1867, "as the originator of the first practical method to lay a telegraph line through the ocean," are couched in rather cautious terms; and as for the decision of the Circuit Court of New York, we must await what the Supreme Court will have to say about the case.

F. HENNICKE.

Reproduction of Eels.

To the Editor of the Scientific American:

In the SCIENTIFIC AMERICAN of January 4th you state that "the mystery which has hitherto attended the propagation of eels has at last been cleared up by the discovery of ripe ovaries by Professor Baird."

In the "Medical Repository," of 1806, of which I have a copy, I find the following, given by Dr. Mitchill: "On the 5th of September, 1806, being on a shooting and fishing party with some friends at Flatland, on Long Island, one of the inhabitants brought from the adjoining bay a basket of uncommonly large salt water eels. He soon began to skin and gut them in our presence; the eels abounded with fat. . . . I examined about a dozen of the eels as they were displayed

before me; I found there were two white organs, which, to an incautious eye, would pass for fat These on a nearer inspection were the roes or ovaria, extending in two long leaves, or legs, from the anus on each side of the spine far toward the neck They were plentifully supplied with blood vessels, and contained numberless ova of a very minute size." Yours very respectfully,

R. K. TELLER.

OFFICE OF THE HANCOCK INSPIRATOR CO., BOSTON.

MESSRS. MUNN & CO.—Permit us again to say that in all our advertising experience we have had no such results from any and all other sources, as from our advertisement in your valuable journal.

Yours very truly,

J. E. BLAKEMORE, Treasurer.

Poisonous Colors.

According to the *Chemical Review*, energetic steps are being taken in Switzerland against the use of poisonous colors. The Governing Council of Zurich has prohibited the use of all coloring matters prepared from the compounds of the metals lead, arsenic, copper, chrome, zinc, antimony, bismuth, and mercury, for decorating articles of consumption or of clothing, or their materials; also paper for wrapping up chocolate, coffee, tea, chiccory, tobacco, and eatables in general; toys, covers and cushions of children's carriages, carpets, curtains and window blinds, lamp screens, wafers, and table services. Poisonous organic matters, such as gamboge, picric acid, the aniline colors, especially magenta, are not to be used for coloring articles of food or drink, such as confectionery, jams, sirups, wines, etc. The same rule applies to the phenol colors. Imported articles containing such poisons may not be sold.

AVELING & PORTER'S ROAD AND FARM LOCOMOTIVE.

The accompanying engraving represents a road and farm locomotive and train of wagons lately built by Messrs. Aveling & Porter for the Kohala Sugar Company, of Kohala, Sandwich Islands, for hauling sugar cane, sugar, for thrashing, and for farm purposes generally. The engine is one of Messrs. Aveling & Porter's newest design. It is fitted with differential gearing and double speed gear varying from two to six miles an hour, and is provided with governors which can be used when the engine is employed in driving stationary machinery. Wrought iron side plate brackets are used for carrying the crank shaft, countershaft, and driving axle. This arrangement, which has been in use on Messrs. Aveling's engines since 1871, has proved of great value in strengthening those parts of a road locomotive most subjected to strain and wear when used on rough roads and on farm lands. The cylinder is steam-jacketed and lagged, and the boiler is made of "best best" plates, butt jointed, carried through flush from end to end; it is double riveted, and is lagged and felted and covered with plate iron and banded in locomotive style. Besides the primal use of the side plate brackets, Mr. Aveling has lately further utilized his invention as a groundwork for the better arrangement of the driving and double speed gear of his engines. The whole of the crank shaft and countershaft gearing is now arranged to work between (instead of outside) the wrought iron brackets, and the fly wheel is fixed close to the crank shaft bearings The pinions for the two speeds are keyed fast upon the crank shaft. The intermediate shaft is fixed, and the sliding sleeve, which carries the spur wheel and the fast and low speed pinions, revolves on it. The two crank shaft pinions are of the same size, and the intermediate spur wheel gears with one or the other as required. The advantages of this improvement are that it decreases the width of the locomotive, and avoids all overhanging gear, the side plate brackets serving as sides to a wrought box in which all gearing is placed immediately over the boiler.

This arrangement strengthens the whole structure.

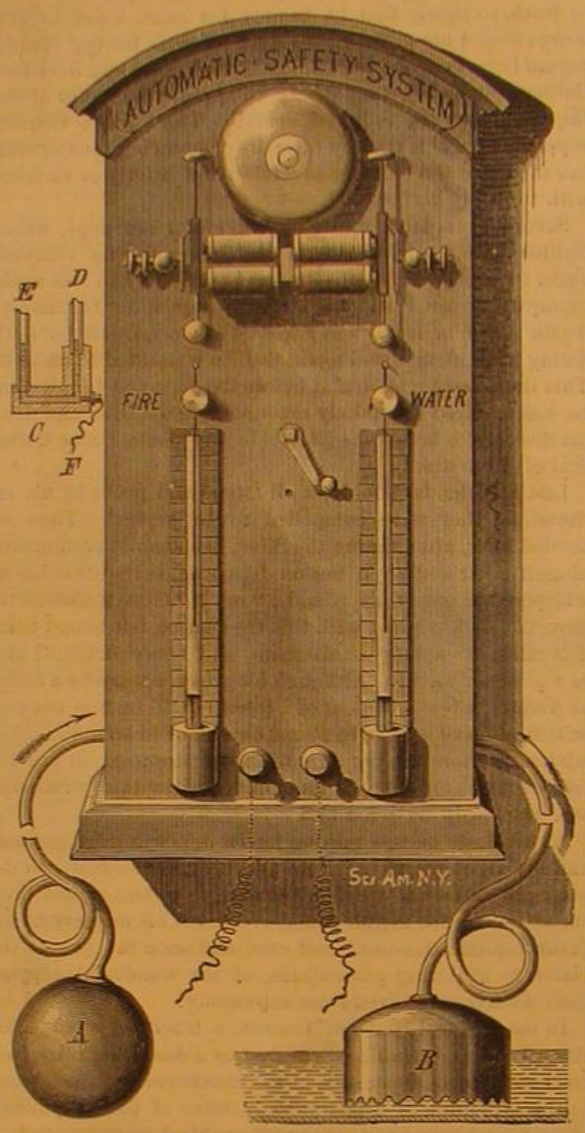
It is stated that this firm have built upwards of 1,600 road and farm locomotives, and number among their customers the governments of Great Britain, France, Russia, Austria, Hungary, Italy, and Mexico.

The British Government has purchased nearly one hundred of these locomotives, the Italian Government sixty-six, and the Russian Government bought them in large numbers at the beginning of the Russo Turkish war for the removal of ordnance and stores.

Mr. Wm. C. Oastler, 43 Exchange Place, New York city, is Messrs. Aveling & Porter's representative in the United States.

FIRE AND WATER INDICATOR.

We illustrate herewith a novel fire and water indicator and alarm, which is the invention of Col. A. Gerard. It was



AUTOMATIC SAFETY APPARATUS.

recently patented in this country, also in Canada and Europe, and is controlled by the Automatic Safety Company, of No. 40 Charles St., New Orleans, La.

The invention consists in a simple arrangement of devices, by means of which the presence of fire or undue heat or any change of temperature may be indicated or recorded at any distant point. The instrument illustrated is also designed for the detection of the presence of water in the holds of vessels.

The two vertical glass tubes shown below the alarm apparatus, and marked "Fire" and "Water," are similar in their construction. The glass tube, D, is inserted in a metallic piece, C, which extends through the support, and has a passage, E, that communicates, in the case of the fire alarm, with the receiver hollow sphere, A, and in case of the water alarm with the bell or receiver, B, which is inverted upon the floor or surface liable to the incursions of water. Needles enter the tops of the glass tubes and extend downward toward the mercury contained in the lower part of the tubes. These needles are in electrical communication with the alarm bell at the top of the apparatus, and the mercury is in communication with the battery wires, the whole being arranged so that the rising of the mercury beyond the prescribed distance in either tube will complete an electrical circuit and operate the alarm apparatus.

The hollow sphere, A, being placed in any distant apartment, a rise of temperature in the vicinity of the sphere expands the air contained by it, creating a pressure which displaces the mercury in the tubes of the apparatus and gives the alarm. Similarly, when the water rises upon the surface on which rests the bell, B, the air in the bell is displaced, and the mercury in the tube marked "water" rises and completes the electrical circuit and gives the alarm.

The necessity of an invention that will with certainty report leakages or fires on shipboard will be recognized by any one having even a cursory knowledge of shipping, and the simplicity and adaptability of the Gerard system will be apparent to our readers.

This apparatus is applicable to buildings as an indicator of high temperatures or fire, and, placed in a cellar liable to flooding, it indicates the presence of water. It is capable of many other applications, which our space will not permit us to enumerate.

Edison's Electric Light.

The Philadelphia *Bulletin* suggests that if Mr. Edison wishes public faith in that electric light of his to remain steadfast, he will have to give an early demonstration of the truth of his claim that it is a practical success. When he first announced that he had solved the problem of dividing the light and of adapting it to domestic uses, there was a very general inclination to accept the story with absolute confidence, because Mr. Edison had proved by his previous inventions that he could achieve some things which had been regarded by other men as impossible. But, after all, the proof of the pudding is in the eating, and the world, after waiting patiently for the public display of an invention which sent gas stocks down as soon as it was heralded, will be disposed, unless Mr. Edison shows his hand, to suspect that the Edison Electric Light and the Keely Motor will have to be ranked together as enterprises which contained much more of promise than of performance.

New Mechanical Inventions.

Mr. Charles F. Brem, of Charlotte, N. C., has patented an improvement in Automatic Car Couplings, and it relates to a construction, whereby the coupling pin, which is pivoted in the bumper, is prevented from being raised out of its bearings in the act of coupling or uncoupling, and is nevertheless adapted to be quickly detached from the bumper when required.

An improved Hydrometer and Liquid Meter has been patented by Mr. John M. Cayce, of Franklin, Tenn. The object of this invention is to provide an improved apparatus, chiefly for use of distillers and the government, for measuring and determining the specific gravity of spirits or alcoholic liquors. This invention cannot be properly described without engravings.

An improvement in Windmills has been patented by Mr. William Frazier, of Centralia, Ill. The object of this invention is to construct the windmill in such a way that the wind will act upon the whole or any part of the surface of the arms or sails.

Mr. C. A. Hussey, of New York city, has patented an Electro Magnetic Motor. The invention consists in providing an electric motor with two stationary and one intermediate rotary magnet, the latter arranged with regard to the other magnets and the commutator, so that the best results are secured.

Mr. Geo. W. Prescott, of Battle Creek, Mich., has patented an improved Buffer for locomotive tanks for coupling them with coaches, using Miller's or any other similar coupling. It will protect the brakeman from being crushed while coupling the cars.

AVELING & PORTER'S ROAD AND FARM LOCOMOTIVE AND TRAIN.

THE OCTOPUS AT THE BERLIN AQUARIUM.

At the Berlin Aquarium there are several live specimens of the octopus, some of which are shown in our illustration, which we take from *Tygodnik Poroszechny*.

These animals have been for some time in the aquarium, and seem to thrive. They are very lively and exhibit a decidedly healthy appetite.

The cuttlefish family comprises several species, some of which have distinct exterior shells, like mollusca, while others are entirely naked and have interior bone-like formations. This group, to which the subject of our illustration belongs, forms a link between the vertebrates and the mollusca. The only remnants of an exterior shell in the octopus are two horny masses embedded in the flesh near the mouth.

The entire structure of the long, oval body of the octopus, with its rough, warty surface, somewhat resembles that of vertebrate animals. The body is symmetrical, both sides being equally developed. The nervous and circulatory systems and the blood corpuscles are also analogous to those of vertebrates. The eyes are well developed and protrude at the sides of the body. Adjoining them are the external respiratory organs. Eight muscular structures surround the mouth. These arms are nearly five times as long as the body, and are supplied with two rows of sucking disks. The entrance of the mouth is supplied with two horny jaws, working vertically like a bird's bill. The tongue is very large and fleshy, partially covered with recurved spines.

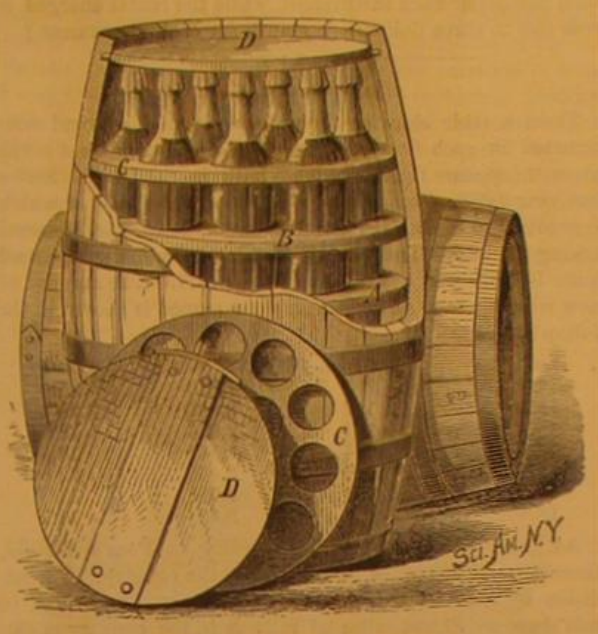
The brain is internally protected by a sheet of cartilage. The backbone consists of a shell-like formation, well known as the cuttle bone. A feature peculiar to all species of this family consists of an interior gland, secreting a brown liquid, which, being expelled by the animal, diffuses very easily in water and renders it cloudy and opaque. This brown liquid is employed as a water color, which is known as sepia.

The octopus moves with great rapidity by means of its arms and the violent expulsion of a quantity of water from the respiratory gills. When chased it instantly discolors the water by the expulsion of the inky liquid and makes its escape, or, by means of its long arms it drags its body into some narrow crevice, from which it can only be extracted by great force. Although frequently left in shallow places when the tide retires, they are nevertheless not very easily caught. In the dark they are slightly phosphorescent. They are all carnivorous and very voracious, swallowing an incredible number of small fish and shellfish, which they seize with their arms, holding them by means of their suckers, and introduce into the mouth.

There are now known about 200 species of the group of *Cephalopoda*, and of the octopus family about 40, the ordinary cuttlefish being the most common. They inhabit the seas of the moderate and tropical zones, and frequent principally rocky shores. They abound particularly in the Mediterranean; in Smyrna, Santiago, aples, and other places, they are regularly exposed at the markets as an article of food. They are ordinarily only a few inches in length, but specimens of five and six feet in length are not rare, and there are numerous cases on record of arms separated from some specimens which measured from ten to twenty-five feet.

BARREL FOR SHIPPING BOTTLED LIQUORS.

The accompanying engraving represents a novel barrel recently patented by Mr. S. Strauss, of Charleston, W. Va., for shipping bottles containing liquors, and for preventing access to the bottles by unauthorized persons.



STRAUSS' SHIPPING BARREL.

The barrel has two removable heads, D, and a stationary middle partition, A. On each side of the middle partition there are two perforated supporting partitions, B C, which hold the bottles so that they are isolated one from the other, and are therefore not liable to breakage when the barrel is moved about. The heads when inserted are locked, so that no one can open them without a key. The lock may be sealed if desirable.

For further information address S. Strauss & Co., Charleston, W. Va.

Natural History Notes.

The Migrations of Animals and Plants.—The question how animals and plants migrate, says Dr. Hagen, in a recent lecture, is an interesting one. Generally the migration took place so long ago that only a conjecture is possible. Nearly everywhere it seems to have been from East to West. Only very few cases in the opposite direction are known; among the most remarkable is that of the potato bug during the last few years. The common cockroach, said to have been originally an inhabitant of Asia Minor, was first observed in an alarming number in English ships 300 years ago; it spread more than 200 years ago from England to France; and 100 years ago more or less slowly, but faster in the time of the Napoleonic wars, through Germany into Russia and Siberia. These facts are proved by the common name given to this disagreeable insect in different countries. In Germany it is called Frenchman; in Russia, Prussian. The most disastrous instance of an eastern propagation is that of the ill-famed phylloxera killing the choicest kinds of grapes known to man. The comparatively new cultivation of America has shed at least some light on the question of migration. In most cases the intruders accompanying emigrants follow strictly the ways of the latter and spread most rapidly along railroads. A careful comparison of the European weeds growing in the United States, and found in Professor Gray's Manual of Botany, represented two thirds of all the European weeds; and, perhaps, some more out of the remaining third. It is a certain fact that in some places the original vegetation is changed remarkably by such intruders. Indigenous plants are killed, and not only the plants, but the insects living on them, so that a keen observer, Baron Von Ostensacken, has stated that particular flies, living exclusively on certain plants, and common in many places in Virginia and adjoining States twenty years ago, are exceedingly rare now, and some species perhaps exterminated. The introduction of plants is often accompanied by the introduction of insects peculiar to them; therefore many enemies of fruit trees, shrubs, and flowers, formerly not known here, are now common. Such insects are even induced to infest indigenous plants belonging to the same order or genus as the imported one. For the same reason, plants entirely foreign to a flora, if introduced, remain at first intact. Besides the well known larger animals for food and agriculture imported from Europe, smaller animals, such as insects, also come over every year. Some butterflies have already made the trip round the world. A large species of fly, well known in Europe by its curious rat-tailed larva, was found here first three years ago, and was so common the past year that hundreds were caught. As steamers make the passage in a week or two, insects are imported living, and go on propagating here. Although

THE OCTOPUS AT THE BERLIN AQUARIUM.

it is common for entomologists to credit Europe with a large number of the imported noxious insects, it must not be forgotten that many are not really native to Europe, but were introduced there from the East ages ago, and not being able to cross the Atlantic till modern times, have settled so long in Europe, as to be considered indigenous species.

Electrical Telegraphing without Wires.

Professor Loomis continues his experiments in the mountains of West Virginia to demonstrate his theory that at certain elevations there is a natural electric current, by taking advantage of which telegraphic messages may be sent without the use of wire. It is said that he has telegraphed as far as eleven miles by means of kites flown with copper wires. When the kites reached the same altitude, or got into the same current, communication by means of an instrument similar to the Morse instrument was easy, but ceased as soon as one of the kites was lowered. He has built towers on two hills about twenty miles apart, and from the tops of them has run up steel rods into the region of the electric current.

Industrial Notes.

Protection of Iron from Corrosion.—A new method of protecting iron from corrosion has recently been patented by Mr. J. B. A. Dode, in England. Its cost is about one third that of a coat of paint, one tenth that of electro-plating with nickel and one twentieth of the ordinary process of painting and gilding. It can also be colored in a variety of ways. Iron treated in this way is said to be "platinized." The articles to be protected are coated with a thin film of borate of lead, containing a little caprous oxide in solution and bright scales of precipitated platinum in suspension. They are then heated to redness and become covered with a thin, glassy, bright gray coat, similar in appearance to polished iron. It is unaffected by sewer gas, dilute acids and alkalies, and the heat of the kitchen fire.

Stearate of Soda for Painting.—A new composition has recently been invented for use in painting. An alcoholic solution of stearate of soda is made in the proportion of 50 grammes of the salt in 1,000 grammes of 66 per cent alcohol. Solutions of soap in alcohol, more or less concentrated, may be used; but the stearate forms the most impenetrable and least costly material. The solution may be colored with aniline colors, yellow ocher, etc. It takes well on wood, lime, and cement.

Bleaching Feathers.—MM. Viol and Duflot have made known a new process of bleaching applicable to the decoloration of ostrich and other delicate feathers which enter into the manufacture of ornaments for ladies. According to the inventors, feathers dipped into a liquid hydrocarbon, such as oil of turpentine, mint, or thyme, become bleached under the subsequent action of light and heat. The process is as follows: The feathers to be bleached are placed in glass vessels filled with one of the above mentioned liquids, and exposed as much as possible to the light of day, and at a constant temperature of 30° C. At the end of two or three weeks the decoloration will be found completed, and it only remains to air the feathers, dry them, and finally to prepare them for use in the usual way.

Caterpillars and Gut.—Silkworms, up to the present time, have been the only larvæ from which "gut" has been prepared. This material has valuable properties—strength, fineness, and color; and if it could be produced in long pieces and at a low cost, it could be used for many purposes. It is now proposed (in the Colonies and India) to use the caterpillars which destroy food plants for this purpose. If practicable, the project is good and useful, and the idea will probably become valuable.

The Hectograph.

Herr Levitus, of Vienna, lately exhibited an arrangement called a "hectograph," for multiplying writing, which, though not directly connected with photography, may prove interesting. The hectograph consists of a flat sheet iron box filled with a gluey mass, upon which, after moistening and drying it several times, a sheet of paper, written upon with a specially prepared ink, is placed and lightly rubbed with the hand. When the paper is raised the writing is found to be transferred reversed to the film of glue, and from that film, by simply placing pieces of dry paper upon it and rubbing them, some fifty impressions of the writing can be taken in a short time. The negative impression can easily be removed from the film by washing with warm water, and the latter can be used over and over again for a long time.

Progress of the Telephone.

The Gold and Stock Telegraph Company, in its answer filed in the suit brought against it by the Bell Telephone Company, sets up the general claim that the telephone is not a new invention, and that Gray was the prior inventor. The Boston case, it is thought, will reach trial by April or May. The Bell Telephone Company has obtained injunctions against several smaller manufacturers of telephones, and suits against others are pending.

The company is turning out 1,500 telephones a month, and orders are so numerous that many are more or less delayed. There are now 17,500 instruments out, and 15,000 actually rented. Instruments are supplied principally to telephonic exchanges, which are being rapidly introduced into all the larger cities. At Albany and Troy there are 350 instruments in circuit; at Buffalo there are 250 subscribers; at Detroit about 150 instruments in circuit; at Chicago 550; at Indianapolis 150 subscribers; at St. Louis 325 instruments in circuit; at Cincinnati 200; at Philadelphia 500 subscribers and 350 instruments in circuit; at Columbus 200 subscribers and about 50 instruments in circuit; at Baltimore 300 subscribers and 100 instruments in circuit; at Washington, New Orleans, Louisville, Nashville, exchanges are being started. In Boston there are 500 subscribers and about 150 instruments in circuit; at Lowell 200 instruments in circuit, at New Haven 350; at Bridgeport 175, and at Springfield, Hartford, and Providence exchanges are being started. An exchange has just been started in this city, where there are at present about 750 subscribers and about 250 instruments in circuit.

[The foregoing we find in the *Operator*. Some idea of the enormous profits made by the telephone owners will be gained when we state that the cost of manufacture is less than one dollar each instrument, while the rental charged is rom two to three dollars per month for each instrument.]

Railway Notes.

From a table showing the mileage of new railroad constructed in each State and Territory during the past seven years, it appears that there were built in the United States last year 2,688 miles of new road, nearly one half of which is credited to the northwest, Minnesota, Iowa, and Missouri taking the lead. The number of miles of narrow gauge road built in 1878 was 871, against 776 in 1877. The amount of new road for each of the seven years named is shown in the following table:

Year.	No. of lines.	Total built.	Av. length.
1872	210	7,340	35·0
1873	137	3,883	28·3
1874	105	2,025	19·3
1875	94	1,561	16·6
1876	107	2,460	23·0
1877	122	2,281	18·7
1878	144	2,688	18·7

At the beginning of 1878, according to Poor's Manual, there were 79,208 miles of railroad in the country. The addition of 2,688 miles is equal to 3⅓ per cent. According to this there are 81,896 miles of railway in the country at this time. Estimating a population of 48,000,000, this gives about 585 inhabitants per mile of railroad, a much smaller number than in any other country on the globe.

In the workshop of the railroad from Moscow to Nijni, the tires of wheels are not expanded by the direct action of fire, but by hot water, before being put on the wheels. With the assistance of a movable crane the tires are plunged into a metallic cistern containing water, which is kept boiling by means of steam from a boiler close by. An immersion for ten minutes expands a tire sufficiently to enable it to pass around the wheel. The heat is more uniform and the contraction more regular than when a tire is heated by fire in the usual way. It is said that in six years there was only one case of fracture of the water-heated tires, and only 1 per cent of them loosened upon the wheel.

In a review of an American work on railway service, the London *Iron* says: We do not allow for a moment that the Americans have beaten Old England either in engineering skill or in sound financial management in railway matters; yet there are a hundred things in either department in which our people may derive benefit from the splendid success and many failures of our American kinsmen. No man can go by rail from London to Inverness or Holyhead without an amount of fatigue and discomfort which would not be experienced in journeys thrice the length in the States; and we hope that our companies at home will in time endeavor to assimilate traveling conveniences a little more to that which in America the length of way has forced upon the great lines of railroad. It is small consolation that to many lines on the continent of Europe, in speed, comfort, safety from robbers, our railway trains are incomparably superior; nothing that the Americans have adopted should be overlooked in our longer lines, whether at home or in India or Canada.

Boston is working for an elevated freight railway to connect the extensive South Boston flats, which are being improved for the reception of freight at tide water, with the Fitchburg, Boston and Lowell, Eastern, and Boston and Maine roads. The track is to be double, and the lower line will pass from these roads through Prince and Commercial streets and Atlantic avenue, crossing Fort Point Channel at Oliver street. The line will be about a mile and a quarter long, and, it is thought, will cost, with terminal switches, engines, etc., less than $1,000,000.

There are at present 66⅛ miles of finished railways in Japan, 142¾ miles laid out, with working plans, sections, and estimates completed, and 455 miles projected, the general route only having been examined and decided upon. The earthworks of the existing lines have been made for a double way, and the bridges for a single way. The permanent way is of double-headed 60 lb. rails on the Yeddo-Yokohama and Kobe-Osaka lines; but on the Osaka-Kiota line 60 lb. flat bottomed rails on cross sleepers are used. The superstructure of the smaller bridges was originally of timber, but has been renewed with iron. The larger bridges are all of the Warren girder type, and as a rule of 100 feet spans. The foundations are on brick wells 12 feet in diameter, and on an average about 60 feet deep. The chief difficulty experienced by railway engineers in Japan arises from the nature of the watershed. The beds of the rivers are nearly all higher than the surrounding country, varying from a few feet to 40 feet or more. In some instances the railway has been taken unders the river by tunneling. As a rule, however, the rivers were bridged over, and approached by steep gradients and high embankments.

Nowhere else in the world have railway engineers to fight against the adverse conditions which beset railway communications in upper India, except, perhaps, on the Baroda and Bombay line. The rivers of the Punjaub are as captious as spoiled children. They shift their course with every rainy season. A splendid bridge is built across what seems the confirmed bed of a river. Next year that river abandons the channel over which the bridge has been thrown, leaves the great bridge spanning a mere rivulet, and carves for itself another channel elsewhere, sweeping away a slice of railway embankment, for which a bridge must be substituted, until, with the necessity for accommodating the fitful caprices of the snow-fed streams, the whole railway system of a large section of the Punjaub threatens to become one long bridge. In the season of the floods the officials of the railway company need to sleep with one eye open, and to live with their lives in their hands. The beds of these Punjaub rivers are littered with ponderous and costly iron work, girders, columns, etc., brought out from England, and now lost irrevocably in the all but fathomless quicksands which stud the river beds.

The Pullman Palace Car Company has been using steel tired paper wheels about nine years. The Chicago *Railway Review* publishes a table showing, from the records of the company, the mileage of a lot of sixty-six wheels on the Pittsburg & Fort Wayne and Pennsylvania roads previous to the first turning up of the tires. The average mileage is over 110,000 miles. As the poorest wheels give out first, it is evident that, by the time the last one is taken off for turning, the average of the whole will be very much greater than is shown by the table. In another table the mileage of twenty-four wheels, the most of which are still in service, is given, and the average is 184,000 miles. As each tire receives from three to four turnings, giving four periods of wear, probably a safe and just estimate from this data would be an average mileage to the steel tire of from 450,000 to 560,000 miles. It appears from the records of the Pullman Company that the average mileage per month of the cars under which the sixty-six paper wheels were run was 13,600 miles. The first cost of the paper wheel is $65, and of the best quality of cast iron wheel, $14. The mileage of the latter is usually guaranteed at 50,000 miles. The cost of renewal of the steel tire is $35. The cost of turning the tire may safely be estimated as equal to the cost of the more frequent renewals of cast iron wheels with the attendant expenses of transportation in each case. The paper wheel costs $65, and runs 450,000 miles in 2 88-100 years. For convenience in reckoning, and at a disadvantage to the paper wheel, on account of the interest money, call this period three years. At the end of this time the original cost, with 7 per cent compound interest, amounts to not quite $80. But during this period nine cast iron wheels have been used, costing $14 each. Allowing a rebate of $5 each for the worn out wheels, and calculating on simple interest at 7 per cent, the cost of the wheels for this service amounts to $91.50, showing a saving in the case of paper wheels of $11.50, and were compound interest computed, as in the case of the paper wheels, the saving indicated would be a much larger amount. In computing the cost for the second period of three years a much greater saving would by shown, since a renewal of the tire only, at a cost of $35, is necessary, instead of a first cost of $65 for a new paper wheel. The data from which this conclusion is reached are vouched for by the Pullman Company. The *Review* adds that the experience of the railway companies which have used the paper steel-tired wheels bears out the records of the Pullman Company. Among these roads it mentions the Central Vermont, Connecticut River; Cleveland, Columbus, Cincinnati and Indianapolis; Pittsburg, Cincinnati and St. Louis, and the Chicago and Alton. As engine truck wheels the paper wheels seem to be especially successful, the experience on some roads warranting the conclusion that they will make 800,000 miles before the tire requires renewal.

The Very Latest Electric Light Improvement.

At the Technical Society of St. Petersburg, M. Latchinoff lately delivered a very interesting lecture on the electric light. He made some experiments with Jablochkoff's condensators, which consist of a set of tin plates placed one on another; the surface of every plate is 0·7 square meter. Between every pair of such plates a piece of silk covered with varnish is introduced. The height of the condensator was about 6 feet. On introducing two condensators into a circuit the intensity of the electric light is doubled. Such condensators are not cheap owing to the great quantity of silk wanted, and thus the application of this apparatus is limited. The lecturer believes the new system of electric lighting devised by M. Rapieff to be a serious opponent of Jablochkoff's process. The chief advantage of the new system is that the luminating point does not change its position, and therefore this system is more suitable for the projection of the electric light at a distance. This advantage will give increase to the use of the electric light for military purposes.

A great deal of difficulty is experienced in cementing metal to glass. The *Fuerber Zeitung* says that a mixture of two parts finely ground litharge and one part white lead, and working it up to a stiff paste with three parts boiled oil and one part copal varnish, adding more litharge and white lead as required, is the best material for joining the two substances.

American Torpedo Boat in Foreign Waters.

Mr. Herreshoff, of Bristol, Rhode Island, America, who has long had a great reputation for the building of small fast steaming vessels, recently sold to the English Government one of his launches in order that the American system might be thoroughly tested against the productions of the English building yards.

The boat is sixty feet all but three inches in length, with a beam of seven and a half feet, and when fully manned and equipped will float in less than four feet of water. Her speed is stated to be over sixteen miles an hour, above the standard of the Admiralty second class torpedo boats, which are nearly as possible of the same dimensions as the American launch. The hull, which in appearance is not unlike a coffin painted a dull gray, consists of bullet-proof steel, with a wooden skin below the water line. The funnel is almost in the middle of the boat, and the screw is placed under the patent boiler, or "steam generator," which is also in the center of the craft. She is steered from near the stern by a balanced rudder, and her powers of quick stopping and going astern, and ability to turn in a small circle, are said to be surprising.

During the trial she described a complete circle in a diameter of about 50 yards, came to a dead stop when steaming 12 miles an hour, in her own length, and then went astern at the same rate of speed and equally well under the control of the rudder. She steamed several times in the course of five minutes round and round a Russian steamer, Peter the Great, proceeding down the river, and amply proved her extraordinary powers to the entire satisfaction of every one on board. The steam is supplied by Herreshoff's steam generator, which will raise 100 pounds of steam within six minutes of the fires being lighted. The generator consists of a coil of 2 inch pipe, nearly 300 feet long, and possesses the valuable quality of an inability to explode. She works at a pressure of steam of 140 pounds, but has been tested up to 300 pounds. The screw is capable of 300 revolutions a minute. The absence of a heavy boiler adds greatly to the lightness of the boat, enabling her to be hoisted on davits with wonderful facility. It seemed to be the general opinion among the engineers present that the introduction of the Herreshoff steam generator into England would create a complete change in the method of producing steam for working machinery, and the success of the new invention appeared complete.

New Electrotype Process.

A new and ingenious process has lately been introduced in France for electrotyping on non-conducting materials, such as china, porcelain, etc. Sulphur is dissolved in oil of lavender spike to a sirupy consistence; then chloride of gold or chloride of platinum is dissolved in sulphuric ether, and the two solutions mixed under a gentle heat. The compound is next evaporated until of the thickness of ordinary paint, in which condition it is applied with a brush to such portions of the china, glass, or other fabric as it is desired to cover, according to the design or pattern, with the electro-metallic deposit. The objects are baked in the usual way before they are immersed in the bath.

CHEST OF EBONY.

The engraving on this page represents an ebony chest, richly ornamented with gilt, bronze, and silver castings and repoussé work. It was one of the exhibits at the late Paris Exhibition.

EBONY CHEST, WITH GILT AND SILVER ORNAMENTS.

Subterranean Telegraph Wires in Germany.

In 1876 the first subterranean telegraph wire was laid down in Germany. Recently, subterranean lines have been completed from Berlin to Cologne, from Cologne to Elberfeld and Barmen, from Frankfort to Strasbourg, and from Hamburg to Cuxhaven. Altogether the length of these lines now amounts to 1,554 English miles. Most of the cables consist of seven wires, very few of four only. The difficulties encountered in laying down the cables in marshy or rocky ground, along the streets of large towns, across, or rather under, rivers, and through fortifications, have all been successfully overcome. Next year six other lines are to be laid down, and then the projected system of subterranean telegraphic communication throughout the German empire will be almost complete. The cost of the lines already laid down amounts to about $3,039,000.

The Origin of Petroleum Springs.

The origin of our oil springs has been the subject of a great deal of investigation among scientific men, and various have been the theories they have advanced. A writer in the London *Grocer* takes the subject up and concludes, as many have before him, that if petroleum were found in the neighborhood of coal, or even in those rocks among which coal abounds, or somewhere near to such rocks, there would not be much difficulty in explaining its origin. We then need only suppose that a slow distillation had taken place similar to that which is carried on at the works for the distillation of paraffine oils from cannel coal or shale, and that the product thus evolved had somehow found its way into cavities, or had filled up crevices, and remained there until disinterred by human effort. This theory would be aided by the fact that the quality of crude artificial paraffine oil approaches more and more nearly to that of natural petroleum the more and more slowly the distillation of the coal or shale is conducted; and as nature has certainly operated very slowly indeed in the formation of geological products, the petroleum of Pennsylvania and Baku, and other places, might thus have been the result of ages and ages of very slow distillation at the low temperature which the mineral oil maker knows to be so favorable to the production of a light-colored crude oil, containing a large proportion of the more volatile products such as abound in natural petroleum. But, unfortunately for this theory, petroleum is not one of the products of the "coal measures," as miners and geologists call the coal bearing strata. It appears to be especially absent from them, or we should long ago have found it in our own island (Great Britain) where these rocks have been so riddled with trial borings, pits, and workings. It is true that a few small dribbles of something of the kind have been found here and there. We have heard of an enterprising publican in the neighborhood of Bilston, who discovered some gas or vapor hissing from the floor of his cellar, who fixed a jet thereto and lighted it, and thus converted the cellar into a subterranean tap room, the curiosity of which brought much custom. His business rivals affirmed that he had carried a gas pipe surreptitiously under ground.

We have ourselves visited a coal mine near Lilleshall, in Shropshire, known as "the tarry pit," on account of the liquid tar that oozed out of the sides of the shaft and accumulated in what the colliers call the "sump," that is, the lower wall of the shaft where it is sunk several feet below the road that leads to the workings for the purpose of receiving the water that has to be pumped out. But these and other similar cases are mere exceptional curiosities, by no means comparable with the vast and apparently inexhaustible subterranean reservoirs from which we derive our commercial supplies of hydrocarbon oils. These occur in the Silurian and Devonian rocks, which are of vastly greater antiquity than our coal-bearing rocks. These Silurian or Devonian rocks belong to the period when life was just making its beginnings upon the earth, or rather in the waters that covered the earth at that time; for the animals whose remains we find in these rocks are marine animals; no air-breathing creature, nor even an amphibious reptile like a crocodile, is found among the Silurian rocks. Nothing approaching to forest trees or other terrestrial vegetation is there; the only vegetable remains being aquatic plants, and these so scarce that small specimens are prized as curiosities. Land plants just begin to make a scant appearance in the Devonian, but are very rare indeed in those lower beds where petroleum is found.

This has led to many speculations. As the remains of odd-looking fishes, marine things like swimming wood lice, huge lobster like brutes (*pterygotus*) five or six feet long and a foot across, a variety of soft animals in shells, and vast quantities of coral, are found in these rocks, some have suggested that petroleum is produced by the decomposition of the flesh of these strange creatures. The very "ancient and fish-like" smell of some of the Canadian mineral oils was regarded as confirmation of this, which in the early days of American petroleum enterprise was a somewhat favored hypothesis. Another, and a very bold, theory has been propounded by Professor Mendelejeff. He maintains that neither the animal nor the vegetable remains of the Silurian and Lower Devonian rocks are sufficiently abundant to supply the petroleum and other bituminous matter they contain. He goes back to the origin of the earth, and to the hypothesis of Laplace, who has tried to show that our sun, our earth, and all its companion planets, were formed by the condensation of an enormous cloud or nebulous mass of heated vapors a few thousands of millions of miles in diameter. He supposes that when our globe was formed by the solidification of a portion of this, there were great masses of iron and of carbon, of inorganic origin, in the inner parts of the earth; that the iron remained melted within the earth long after the crust had cooled down and water had condensed upon it. Then this water found its way through fissures and came upon the molten iron and the inorganic carbon or graphite that was associated with it. What would happen then? Water is composed of oxygen and hydrogen. Iron has a strong affinity for oxygen—strong enough, when heated, to take it away from the hydrogen of water. Mendelejeff supposes that such a decomposition of water took place, that the iron was thereby converted into the oxide of iron (the iron ore that we now obtain for our blast furnaces), and that the hydrogen set free from the water combined with the carbon, and thus formed the hydrocarbons which are found in the forms of petroleum, asphalt, etc.

Dr. T. Sterry Hunt, of Massachusetts, one of our boldest and most able of philosophical geologists, still adheres to the theory he expounded in 1861, that "petroleum and similar bitumens have resulted from a peculiar transformation of vegetable matters, or in some cases of animal tissues analogous to these in composition;" and he derives these vegetable matters and animal tissues from the ancient limestones. He argues that the animals of very low organization, that resemble plants in so many respects, are composed of material also chemically resembling vegetable matter, or a sort of half-and-half between wood and flesh, and that this, in the course of ages, would decompose and produce hydrocarbons. If this is correct, he may find his supply in the coralline rocks of that period, and may get it in such quantities as to leave us in no apprehension as to failure of supply; and he actually has found certain oleiferous magnesian limestones which contain within their pores as much as 4½ per cent of their bulk of petroleum supposed to be thus formed. A square mile of this only one foot in thickness would contain 221,247 barrels of 40 gallons each; and taking its actual thickness at 35 feet, every square mile contains 7,743,745, or nearly 8,000,000 of barrels, all this in store and ready to ooze and filter out into the cavities as they become pumped out. Whatever theory may be adopted, one important practical fact appears very certain, namely, that the supply of petroleum is by no means limited to the present contents of the oil wells, or the accumulations in the cavities which are tapped by the wells. This is shown by the fact that after a well has been pumped dry and then left for a while the oil returns, as though it came from such porous rock as the oil-bearing limestone of Chicago which Dr. Sterry Hunt examined. As this and other similar rocks cover some thousands of square miles of the American continent, the supplies of petroleum are likely to be quite as lasting as those of coal.

Practical Value of Science.

BY PROFESSOR S. H. TROWBRIDGE.

Can the study of geology be of use to any outside of the guild? Let us see, for a moment. The science of geology, dealing as it does with the only visible record of any considerable age, in regard to the history of life upon our planet, must settle the vexed questions—if they are ever to be settled—of the origin of species the antiquity and perhaps the unity of man. To many, the acceptance of the new theories on these points is equivalent to legislating God out of the universe. If so many are wrecked upon these questions, the correct understanding of them is a matter of no little importance.

Has a farmer any interest in knowing whether mineral products are to be found upon his land, and, if so, whether they are valuable, and in paying quantities? Has he coal, iron, lead, zinc, baryta, ocher, peat, or clay, valuable minerals or mineral springs, or rock fit for building purposes, within his limits? These questions must be answered, if at all, by the geologist. These products are found in certain layers or groups of rocks, whose position is definitely known by certain marks easily recognizable. These marks are the remains of the buried dead of ages past, that have written their own epitaphs upon the rocks, which serve the double purpose of sepulcher and tombstone. Many a man has spent all his living in trying to extract gold or other valuable minerals from deposits which one initiated could tell him at a glance were entirely worthless. Many a man has sunk a fortune in mining for coal, lead, zinc, or other ores, on the unsafe supposition that, because his neighbor in the valley below him finds these in abundance, he will have equal success by sinking a shaft to the same level. A brief survey of the inclination of the rocky strata would show that the rocks which his neighbor finds so productive, dip away from him; or, by an upward curvature of the earth's crust, which formed the elevation on which he stands, the wealth-bearing stratum was exposed, on the surface, to the action of frost and flood, and has been completely washed away.

From bitter experiences like these, prospectors and miners have learned that knowledge and advice of a well versed geologist is invaluable to them, and have not hesitated to offer and pay a thousand dollars per day for his services.

From later geological study of Hoosac Mountain, it seems probable that millions of dollars might have been saved to the State of Massachusetts if such a study had preceded the excavation of the great Hoosac Tunnel. The assertion is ventured that enough funds were needlessly expended to pay for a complete topographical, geological, zoological, and botanical survey of the whole Commonwealth, such as no State in the Union now possesses, and such as would for ever put away the danger of similar loss in the future.

How to make two blades of grass grow where one grew before; and how, in general, to get the most out of this rich old earth of ours, is the absorbing question of all ages. In the van of all exploring expeditions goes a band of scientists, or at least the geologist, to learn of the wealth which the earth possesses. And when the settler is ready to seek a home in the distant land, he finds that science has furnished for him a satisfactory showing of the natural wealth of his future home; and by the use of these revelations of scientific research, he may select beforehand his locality, and carry with him the information concerning it.

The cost of production of the precious metals, and their probable abundance for years, decades, and centuries to come, must be determined by the geologist. Upon this knowledge depends the value of gold and silver, as standards of value and media of exchange. From this source we learn that the amount of gold obtainable is constantly diminishing, while that of silver is slowly increasing. The former is much more fluctuating than the latter, hence a less desirable standard of value; and as each acts as a check upon the other, there is wisdom in accepting both as media of exchange. From this we see the important part the geologist plays in the mooted question as to the demonetizing of silver.—*The Advance.*

Stimulation of the Nerves of the Head.

Dr. Brunton, in the *Contemporary Review*, remarks that there are two nerves, known as the "fifth pair," which are distributed to the skin of the head and to the mucous membrane of the eyes, nose, and mouth. These nerves are closely connected with the heart and vessels, and by stimulating their branches the circulation may be greatly influenced, as in the case of fainting. It is a curious fact that people of all nations are accustomed, when in any difficulty, to stimulate one or another branch of the fifth nerve, and quicken their mental processes. Thus, some persons when puzzled, scratch their heads; others rub their foreheads; and others stroke or pull their beards, thus stimulating the occipital, frontal, or mental branches of these nerves. Many Germans when thinking have a habit of striking their fingers against their noses, and thus stimulating the nasal cutaneous branches, while in other countries some people stimulate the branches distributed to the mucous membrane of the nose by taking snuff.

The late Lord Derby, when translating Homer, was accustomed to eat brandied cherries. One man will eat figs while composing a leading article; another will suck chocolate cremes; others will smoke cigarettes; and others sip brandy and water. By these means they stimulate the lingual and buccal branches of the fifth nerve, and thus reflexly excite their brains. Alcohol appears to excite the circulation through the brain reflexly from the mouth, and to stimulate the heart reflexly from the stomach, even before it is absorbed into the blood. Shortly after it has been swallowed, however, it is absorbed from the stomach, and passes with the blood to the heart, to the brain, and to the other parts of the nervous system, upon which it then begins to act directly. Under its influence the heart beats more quickly, the blood circulates more freely, and thus the functional power of the various organs in the body is increased so that the brain may think more rapidly, the muscles act more powerfully, and the stomach digest more easily. But with this exception, the effect of alcohol upon the nervous system may be described as one of progressive paralysis. The higher centers suffer first, and the judgment is probably the first quality to be impaired, and this becomes the more so as the effect of the alcohol progresses, although the other faculties of the mind may remain not only undiminished by the direct action of the alcohol on the brain, but greatly increased by the general excitement of the circulation. By and by, however, the other parts of the nervous system are successively weakened, the tongue stammers, the vision becomes double, the legs fail, and the person falls insensible. It is evident, then, that only the first stages of alcoholic action are at all beneficial, the later stages being as clearly injurious.

A New Method for Vapor Densities.

The most important element in determining the formula of a chemical compound, next to its percentage composition, is its vapor density, and often this is the quickest and surest method, if not the only one, to establish its atomic weight. The number of methods proposed and introduced is legion, every prominent chemist—Hofmann, Bunsen, Gay-Lussac, and Dumas—has given his name to some apparatus for that purpose. The latest and simplest is that of Victor Meyer, in Zurich, Switzerland.

A glass vessel holding 100 c.c., and resembling a flask with long and very narrow neck, on which is set a fine tube bent like a gas delivery tube, is used. The widened mouth of the flask is closed with a rubber cork which reaches to a certain mark on the neck. The delivery tube dips under the surface of mercury or water in a pneumatic bath. The vessel being placed in another and larger vessel of water, oil, or easily fusible metal, can be heated to any desired temperature. For a while the air in the flask of course expands and escapes through the mercury or water. When all the air in the flask has reached the temperature of the bath no more will escape. At this point the opening of the delivery tube is closed, the rubber stopper removed, a weighed quantity of the substance is thrown in, and the stopper quickly replaced to the mark. Some asbestos on the bottom of the flask breaks the fall and prevents its breaking the flask. If now the temperature of the flask is higher than the boiling point of the substance introduced it will be converted into a vapor, and must expel a quantity of air exactly equal in volume to the volume of vapor generated. If the volume of the vapor generated is not over one quarter or one third that of the flask, and it is quickly vaporized, the error through diffusion will be very small. The air expelled is collected over water in a graduated tube, or in a common eudiometer, and differs so little from that of the vapor generated that it may be neglected in determining the molecular weight of body, as shown by the following figures found by Mr. J. Zueblin:

	Theory.	Found.
Chloroform (with steam)	4·13	4·32; 4·51; 4·44; 4·36
Bisulphide of carbon (with steam)	2·63	2·87; 2·91; 2·92
Chloroform (in aniline)	4·13	4·31
Water (in aniline)	0·62	0·69; 0·66; 0·62
Aniline (in ethyl benzoate)	3·21	3·27; 3·37
Phenol " "	3·25	3·28; 2·98

It is characteristic for this process that it is independent of the capacity of the vessel and of the temperature at which the experiment is made. It is only necessary to know the temperature of the room, the weight of the substance, the barometer, and the volume of the air expelled into the tube. The vapor density of substances which boil at very high temperatures can be determined in metal bath at very high and unknown temperatures. It may be used as a lecture experiment also.—*Berichte.*

Liquefaction of Oxygen.

Mr. Raoul Pictet concludes an article on the liquefaction of oxygen with the remark that his investigations necessitated an unusually large number of experiments for the establishing of preliminary data, and these he obtained by aid of the Geneva Society for the Construction of Physical Instruments, who furnished him with apparatus worth 50,000 francs, and thereby enabled him to work out results with perfect accuracy. He recommends that similar apparatus should be provided in all laboratories as an "essential means for the study of the molecular forces. Who knows," he asks, "but what crystallization and certain reactions may thereby be placed in peculiarly favorable conditions for further investigation?"

Roach Poison.

For the benefit of several subscribers, who have written for information as to the best means of ridding their houses of cockroaches, we may state that equal parts of powdered borax, Persian insect powder, and powdered colocynth, well mixed together, and thrown about such spots as are infested with these troublesome insects, will prove an effectual means of getting rid of the scourge. This powder, in all cases where its use has been persistent, has by long experience been found an infallible remedy.

Cooked Air.

A clever writer in the Philadelphia *Ledger* very happily characterizes the air which most city people breathe indoors in cold weather as "cooked air." The lower down the thermometer goes the higher the burning coal is piled; all the chinks and cracks are stopped that would let any fresh air in, and its main chance, indeed, is when the front door opens for twenty seconds, or when the beds are made in the sleeping rooms. In the living rooms of the family there is no occasion, many people think, to raise the windows ever, except to wash them on periodical cleaning days, or to close the shutters. So carpets and furniture and people, lungs and skin, are dried and baked in the hot, dry rooms, until ingenious persons can bring out electric sparks from their finger ends by skating rapidly up and down the room in their woolen slippers.

These breathers of cooked air are often extremely particular about wearing their own clothes, and would by no means consent to take the cast off garments of a neighbor; yet one and all of them are perfectly comfortable to breathe over and over again the cast off and soiled air from each other's lungs, when it is cooked especially; for in summer time they do insist on a change of it, and do get their houses ventilated. Janitors of public buildings, in a short sighted economy of fuel, will shut up all the apertures by which fresh air might get in, lest they should suffer some heat to escape thereby, and are rewarded by sleepy audiences, especially when the gas burners are at work, also draining the cooked air of what little life it has. There are some people —many, it is to be hoped—who open an inch or two of their bedroom windows every night to insure a modicum of fresh air to sleep by. But these do not in the least care to have fresh air to be awake in, it seems, for they are content to have their furnace draw all its supplies from the tightly sealed cellar, and from the stale atmosphere of the ash boxes and vegetable bins in that subterranean apartment. And these breathers of cooked, soiled, devitalized, and debilitating air, wonder why it is they take cold so easily! The writer suggests that when people learn to live in fresh air within doors as without, with its proper proportion of moisture for the skin and breathing apparatus to keep up their healthy tone, it is likely they will have found out one way at least of how *not* to take cold.

Oxide of Zinc in Diarrhea.

The value of oxide of zinc in diarrhea has long been known, but is apt to be overlooked. Some recent reports on the subject have been made by Dr. Tyson, of this city, and Dr. Bonamy, of Nantes. The formula which the latter uses is:

R. Zinci oxidi	54 grains.
Sodæ bicarb	7½ "

In four packets, one to be taken every six hours.

In all the cases which he observed oxide of zinc produced rapid cure of diarrhea. In fourteen cases observed by Puygautier the cure was even more rapid, since in only one case were three doses of the medicine required. The results are considered to have been more satisfactory, inasmuch as in several cases the malady had endured from one to many months, and other methods of treatment had not produced any improvement. Thus he concludes that, although by no means to be held as exclusive treatment, the employment of oxide of zinc deserves to be more generally known as useful in diarrhea.—*Med. and Surg. Reporter.*

Antimony in Galvanic Batteries.

Nuhn calls attention to the use of metallic antimony for galvanic batteries in the place of the carbon or platinum as negative element, especially when sulphuric acid is the liquid employed. He has used it for five years for medical purposes with satisfactory results. It has the advantage of cheapness, does not scale off, or break, or crumble; the piece retains at all times its market value, and can be fused over again at any time. The chief advantage is that the antimony begins to act as soon as it is immersed, which is seldom the case with carbons. On the other hand the chief disadvantage is that thin plates of cast antimony break easily, but this can be avoided by casting it around a core of tough metal, like copper, or by alloying it with a few per cent of a tenacious metal. Although it is not as good a negative element as carbon, its greater conductivity and other advantages make it probable that antimony may frequently prove useful as a galvanic element. Antimony melts at 425° C. (797° Fah.); in other words, it is a comparatively easily fusible metal, a little higher than lead, but, like zinc, will burn if exposed to the air while melted. Bismuth can probably be employed for the same purpose, standing very close to antimony in the electrical series.

Sewing Silk Manufacture.

But few persons who use sewing silk know the various and intricate processes the material has to undergo to produce the even thread and beautiful colors which they purchase at our stores for a few cents a spool. A recent visitor to a sewing silk factory, at Clinton, Mass., describes on another page the process of its manufacture. We invite the reader's attention to the article.

AT a recent soiree of the Union League Club, in this city, during a promenade in the picture gallery, a piece of white hot carbon dropped from an electric light upon the costly silk train of a lady visitor, and instantly burned through the fabric. The coal was quickly extinguished. No damage except to the dress.

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An experience of more than thirty years, and the preparation of not less than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. In addition to our facilities for preparing drawings and specifications quickly, the applicant can rest assured that his case will be filed in the Patent Office without delay. Every application, in which the fees have been paid, is sent complete—including the model—to the Patent Office the same day the papers are signed at our office, or received by mail, so there is no delay in filing the case, a complaint we often hear from other sources. Another advantage to the inventor in securing his patent through the Scientific American Patent Agency, it insures a special notice of the invention in the SCIENTIFIC AMERICAN, which publication often opens negotiations for the sale of the patent or manufacture of the article. A synopsis of the patent laws in foreign countries may be found on another page, and persons contemplating the securing of patents abroad are invited to write to this office for prices, which have been reduced in accordance with the times, and our perfected facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN.

Business and Personal.

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

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Valves and Hydrants, warranted to give perfect satisfaction. Chapman Valve Manuf. Co., Boston, Mass.

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To Manufacturers of Firearms.—The right to manufacture a first-class breech-loading, long range rifle for target or sporting purposes, may be secured by addressing W. M. Clarke, 362 Plane St., Newark, N. J.

Corliss Engines. Watts, Campbell & Co., Newark, N.J.

Any of our readers in the smaller cities and towns, who are seeking employment, or who wish to add to their incomes, would do well to correspond with the H. W. Johns Manufacturing Company, No. 87 Maiden Lane, New York. Their Asbestos Roofing, Steam Pipe, and Boiler Coverings, round and flat Steam Packing, Fireproof Sheathings, Coatings, Cements, etc., are universally needed, and find a ready sale at all seasons of the year. This company are also the most extensive manufacturers in this country of strictly first-class Liquid Paints for dwellings and general structural purposes, and they offer liberal inducements to reliable men as local salesmen.

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Bunnell's New Nickel Solution; rapid in action; white and perfect deposit on all metals; works on zinc, iron, solder, etc., without coppering; easily managed; and low price. Guaranteed to infringe no patent. Bunnell, 112 Liberty St., New York.

Catalogues and Circulars of our latest Scientific Publications, mail free. E. & F. N. Spon, 446 Broome St., N.Y.

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H. Prentiss & Company, 14 Dey St., N. Y., Manufs. Taps, Dies, Screw Plates, Reamers, etc. Send for list.

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Belcher & Bagnall, 25 Murray St., N.Y., have the most economical Steam Engines, Boilers, Pumps, in market; also improved wood and iron working machinery.

Hydraulic Elevators for private houses, hotels, and public buildings. Burdon Iron Works, Brooklyn, N. Y.

Bolt Forging Machine & Power Hammers a specialty. Send for circulars. Forsaith & Co., Manchester, N. H.

For Sale Cheap.—Second-hand 8 foot Boring and Turning Mill, Lathes, Planers, Drills, Bolt Cutters, etc. Circulars. D. Frisbie & Co., New Haven, Conn.

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For Sale.—Brown & Sharp Universal Milling Machine; Bement Profiling Machine; first-class 2d hand Machine Tools. E. P. Bullard, 14 Dey St., N. Y.

Send for circulars of Indestructible Boot and Shoe Soles to H. C. Goodrich, 40 Hoyne Ave., Chicago, Ill.

Nickel Plating.—A white deposit guaranteed by using our material. Condit, Hanson & Van Winkle, Newark, N.J.

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Manufacturers of Improved Goods who desire to build up a lucrative foreign trade, will do well to insert a well displayed advertisement in the SCIENTIFIC AMERICAN Export Edition. This paper has a very large foreign circulation.

J. C. Hoadley, Consulting Engineer and Mechanical and Scientific Expert, Lawrence, Mass.

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Dead Pulleys that stop the running of loose pulleys and their belts, controlled from any point. Send for catalogue. Taper Sleeve Pulley Works, Erie, Pa.

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The SCIENTIFIC AMERICAN Export Edition is published monthly, about the 15th of each month. Every number comprises most of the plates of the four preceding weekly numbers of the SCIENTIFIC AMERICAN, with other appropriate contents, business announcements, etc. It forms a large and splendid periodical of nearly one hundred quarto pages, each number illustrated with about one hundred engravings. It is a complete record of American progress in the arts.

Notes & Queries

(1) J. J. B. asks how water colors are mixed and formed into cakes, and what kind of paint is used. A. Mix almost any of the finely ground pigments with a thin mucilage of gum arabic, or dextrine.

(2) W. H. A. asks: 1. How to cast metals, such as zinc, copper, German silver, antimony, and britannia, in plaster of Paris moulds. I want to make very fine work, taken from nature, leaves and flowers, which cannot be cast in sand. A. See SCIENTIFIC AMERICAN SUPPLEMENT No. 17, for full directions for casting soft metals in plaster moulds. 2. How to make a small furnace, to melt about from 10 to 20 lbs. of metal. A. Any of the fusible metals or alloys may be melted in an iron ladle over a common fire. Copper, brass, German silver, and the metals which fuse only at high temperatures, may be melted in a crucible in a draught furnace, which is simply a modification of a common coal stove.

(3) G. H. writes: I have a plano-convex lens two and three quarter inches in diameter and three quarters of an inch thick in the thickest part. Could I use it in a camera obscura? A. The focus of your lens is too short for a camera obscura.

(4) H. W., Jr., asks how to temper steel to the hardest possible degree. A. Heat it to a cherry red and plunge in mercury. As the vapor of mercury is deleterious it should be used with great care.

(5) F. S. C. asks: What boiler should I use for a steam buggy to go on a common country road? Give size and weight of boiler and engine, weight of water and fuel. [Perhaps some of our readers who have experimented with such wagons will be kind enough to furnish some account of their attempts.]

(6) C. F. F. asks: What would be the suitable size pipes for vacuum pan, which is fed by a one and one quarter inch live steam pipe, always open full? Also, should a check be used between the boiler and the pan, same as pump? A. It is generally best to use a check valve, and there is nothing gained by making the drain pipe larger than the supply. It should lead from the vacuum pan on an incline, and should be arranged with a vertical fall to the boiler, if possible. Unless the lowest point of the vacuum pan is above the water level of the boiler, a trap or its equivalent will be required.

(7) J. L. K. asks: 1. For recipe for cement for fastening brass collars to kerosene lamps (not plaster of Paris). A. The following is recommended by Puscher: Caustic soda, 1 part; rosin, 3 parts; water, 5 parts; boil until complete saponification is effected and mix the product intimately with one half its weight of zinc oxide, white lead, chalk, or plaster of Paris. The latter is preferred, as it hardens more quickly. 2. I have some paint brushes which are quite hard (paint dried on them) and useless. Can you tell me how to remove paint without injuring brushes? A. Long soaking in benzole or carbonic sulphide will in some cases suffice.

(8) C. F. S. writes: 1. I have an open fire place or grate for heating rooms on first story, with air-tight ash pits underneath in the cellar. There is an opening through which the ashes fall into the ash pit. How can I prevent the fine ashes from flying or blowing back when we let the ashes from under the grate down through the ash pit? A. You might make a box or trap having a door at the top and bottom. Into this, with the lower door closed, dump the ashes, then close the upper door and open the lower one. 2. Also, what will take tobacco and other stains out of marble? A. Moisten caustic lime with washing soda, and cover the marble with this for a few hours; then rinse and scour with strong soapsuds and a stiff brush, rinse again and rub dry with a cloth.

(9) H. H. M. asks: 1. With what number of wire shall I wind the core for the gas pipe magnet described in your paper some time ago, core to be of 1 inch pipe, 3 inches long? A. The size of wire depends upon the use to which the magnet is applied. 2. How much wire shall I use to make a good magnet? A. About 5 or 6 layers. 3. Will such a magnet, with three or four gravity cells, be sufficiently strong to make good telephone magnets? A. This form of magnet is not adapted to telephones. See SCIENTIFIC AMERICAN SUPPLEMENT No. 142, for directions for making telephones. 4. How should the coils be arranged; should each coil be independent, and all joined to a common conductor, or should there be one continuous circuit through them all? A. The telephones should all be in one circuit.

(10) W. S. A. asks what makes solid iron float in melted iron. Is it on the same principle as the floating of ice? A. Yes.

(11) H. P. W. writes: I have a riveted boiler iron tube two hundred and forty feet long and twenty-eight feet diameter to lead the water to a turbine wheel. Can I protect it against rusting by painting, and with what kind of paint? A. Apply one or two good coats of asphaltum varnish, allowing each coating to dry or harden thoroughly. If the water moves with great velocity, paint or varnish will not last very long on the interior.

(12) B. F. S. asks: 1. Can you tell me how asphaltum is prepared or where it is obtained? A. Asphaltum, also known as bitumen, is a black, glossy, brittle resin, probably formed by the gradual oxidation of petroleum. It occurs very abundantly on the island of Trinidad, on the northern coast of South America, at the mouth of the Orinoco, on the waters of the Dead Sea (anciently *Lacus Asphaltites*), and in several other localities. It is somewhat soluble in alcohol, and readily so in naphtha, benzole, and turpentine. It is used in varnish making (iron varnish), in engraving copper and steel as an etching ground, and as an oil paint. Asphalt mixed with gravel, sand, lime, limestone, etc., is largely used for paving purposes, being durable and somewhat elastic. 2. What are its uses, and can it be used with success in cold climates on account of frost? A. As far as we know it has been used for this and other similar purposes in cold climates with good results.

(13) A. P. asks: To increase the speed of our mill, which would be the most advantageous, to increase the size of pulley on shaft or decrease the size of pulley on mill spindle? A. The former.

(14) G. M. asks: 1. Is it necessary for the helix to exactly fit the bar of steel to be magnetized? A. No, but a good fit gives the best results. 2. How much and what size wire must I use for making magnets? A. This depends entirely on the size of the magnet and the power of the battery. See SCIENTIFIC AMERICAN SUPPLEMENT No. 142, directions for making telephone magnets. 3. Can it be made any stronger by leaving it in longer, than pushing it once nearly through and then back to its place and then breaking the current? A. No.

(15) C. R. H. asks: Is it possible for a number of persons to move a table by electricity by placing their hands upon it, without pressing upon it? A. No.

(16) "Imperial" asks in what country locomotives were invented, and when. A. In France, 1769, by Cugnot.

(17) N. H. B. asks for recipe for bronze blacking for leather. A. Make a concentrated solution of RRB methyl violet in a boiling solution of 4 parts shellac in 1 part of borax, and about 15 or 20 parts of soft water.

(18) J. B. asks: 1. What chemicals are used in Babcock fire extinguishers? A. The tank is half filled with a strong solution of carbonate or bicarbonate of soda, over which is suspended a leaden cup containing commercial sulphuric acid. 2. Can I use the chemical for fire extinguisher without using their apparatus? A. Yes. 3. Is there any other chemical which will act and answer for the same purposes? A. Carbonates of lime, potassa, iron, etc., with any of the stronger acids, will answer nearly as well, if economy is not considered. The acids must of course be kept in vessels not corroded by them.

(19) G. J. asks: What is a horse power? From whence did it originate? What is the horse power of the United States? A. A horse power is the equivalent of 33,000 foot lbs. of work per minute. The expression was first used by James Watt, we believe. According to the census of the United States, taken in 1870, the steam power employed in manufactures was 1,215,711 horse power, and the water power, 1,130,431 horse power.

(20) O. A. S. asks: 1. In making an electro-magnet for a magneto-electric machine, is it better to use coarse wire (No. 24) or fine wire (No. 32), and which gives the better result? A. The magnets are generally wound with coarse wire, from No. 4 to No. 16, according to the style of the machine. The armature is wound with fine wire for intensity and coarse wire for quantity. 2. Are "Notes and Queries" in the SCIENTIFIC AMERICAN Export Edition? A. Yes.

(21) C. H. A. asks: 1. Can charcoal be used for the carbon in the battery described in No. 149, SUPPLEMENT, in "How to Make an Electric Light"? A. No. 2. How is the wire fastened to the zinc plate? Will merely putting the wire through a hole in the zinc and twisting it answer? A. Yes. 3. Does the amalgam serve any purpose other than to keep the zinc from being destroyed rapidly? A. It improves the efficiency of the battery and keeps the zincs clean. 4. How can I make an iron mould for making carbon according to the directions given in the above mentioned article? A. Make a pattern and have it cast. 5. How is oxygen made from chlorate of potassa and binoxide of manganese? A. Potassium chlorate, 4 parts; pure manganese binoxide, 1 part; heat the mixture in a retort of porcelain, earthenware, glass, or iron, until no more gas is given off. 6. What is the peculiar odor which arises when hydrogen is being made with zinc clippings and sulphuric acid? A. It is due to impurities in the zinc, and may be removed by passing the gas through strong solutions of potash and silver nitrate. 7. Is there any truth in the statement that cotton is more quickly bleached when under peach or apple trees in bloom, than when placed anywhere else on the grass in the sun, the goods of course treated alike in other respects? A. No.

(22) C. F. S. asks if the true ratio of the circumference of a circle to its diameter has ever been found. A. If you mean the numerical value of this ratio, we answer, no; although the difference between the number used and the true number is so small as to be of no practical importance.

(23) J. R. G. writes: I see in SCIENTIFIC AMERICAN, January 4, the article "A Fast Little Side Wheeler" by C. A. Thompson, Owego, N. Y. He used vertical boiler and a small boat for private use. Please tell me whether his boat was commissioned by United States officers. I did not know that such a boiler would be allowed. I wanted to use such a boat, but the United States officers said it must be commissioned and I must use licensed pilot, captain, and engineer. A. All boats using steam power are subject to the United States inspection laws. In some sections of the country, we have heard that vertical boilers are not allowed, but we would be glad to receive more detailed information from inspectors or others who are familiar with the special regulations in such localities, and the reasons for the same.

(24) H. H. H. asks: 1. How does the injector work? Please give a full explanation. A. Bourne, in his "Treatise on the Steam Engine," gives a concise explanation which is quite satisfactory: "As the power resident in a jet of steam is expended in giving momentum to its particles, it is clear that any instrument which recovered this power from those particles, and expended it without waste, would produce the same effects which are producible by the expenditure of the same quantity of steam in an ordinary engine. This is what is done, with more or less efficacy, by Giffard's injector, an essential condition to the action of which is, that the water supplied to it shall not be so hot as to refuse to condense the steam. As the steam itself disappears, the power previously existing in it is expended in the propulsion of the water, and the amount of that power is sufficient to force the water into the boiler in opposition to the pressure of the steam." 2. Also, what is the size of the Great Eastern, and what size engine is used to run her? Give dimensions of cylinder. A. The Great Eastern is 680 feet long, 82½ feet broad, and 58 feet depth of hold. She has four screw engines, 84 inches diameter of cylinder, 4 feet stroke, and four paddle engines, cylinders 74 inches in diameter, 14 feet stroke. 3. Also what is the size of the largest steamboat run on the Ohio river? A. We must ask some of our Ohio readers to answer this question.

(25) S. A. writes: I have a high pressure engine, 30 inches cylinder, 60 inches stroke. I think of putting in a condenser. Which will give the best result, a jet condenser or a surface condenser? I have a large pond of water of 5 feet fall that I can run through the surface condenser, which I think will save the expense of a pump. All the pump I would require would be a small one about 3x6 inches to draw the water from the condenser and force into the boiler. A. From your description we think your plan for the application of a surface condenser is good.

(26) Ph. D. says: In amalgamating zincs I have used a solution of 8 ounces of mercury in a mixture of 1 lb. of nitric and 5 lbs. of hydrochloric acid. It was only necessary to dip the zinc for a moment in the milky liquid thus prepared to obtain a good coating of mercury. Lately, using the same proportions and acids of the same quality (so the druggist tells me), I have met with poor success—the solution looks less milky and it is necessary to rub the metal hard with the brush to get any coating at all. The zincs are well cleaned before putting them in the mercury solution. Is it possible the temperature has an effect? A. The acids laterally used were probably stronger or warmer than formerly, in which case a larger proportion of mercuric salt formed. The milkiness is due to basic nitrates and calomel. Dilute the nitric acid a little and allow the solution to take place in the cold.

(27) T. S. asks how phosphorescent sulphide of calcium, called Canton's phosphorus, is prepared. A. 3 parts of clean oyster shells or mother-of-pearl are reduced to impalpable powder, mixed intimately with 1 part of flowers of sulphur, and the mixture strongly heated in a crucible for an hour. Grotthusz directs that the powdered oyster shells be placed in alternate layers with the sulphur and heated for some time at a moderate temperature.

(28) T. D. F. asks how to make seidlitz powders. A. Tartrate of soda, 2 drachms; bicarbonate of soda, 2 scruples; mix and wrap in blue paper. Tartaric acid, 35 grains; powder, and put in white paper.

COMMUNICATIONS RECEIVED.

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

On Square Measure. By M. C.
On the Metric System. By W. F. Q.
On a Camera Lucida. By S. B.

[OFFICIAL.

INDEX OF INVENTIONS

FOR WHICH

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

January 7, 1879,

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.

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Value of Patents and How to Obtain Them.

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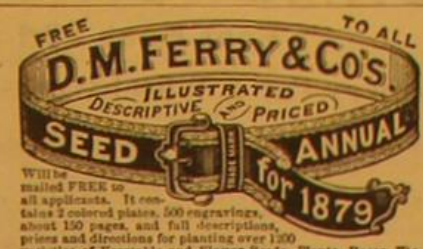

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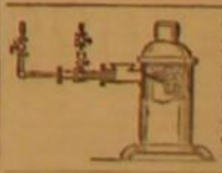

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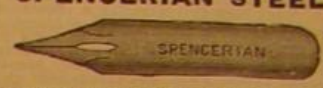

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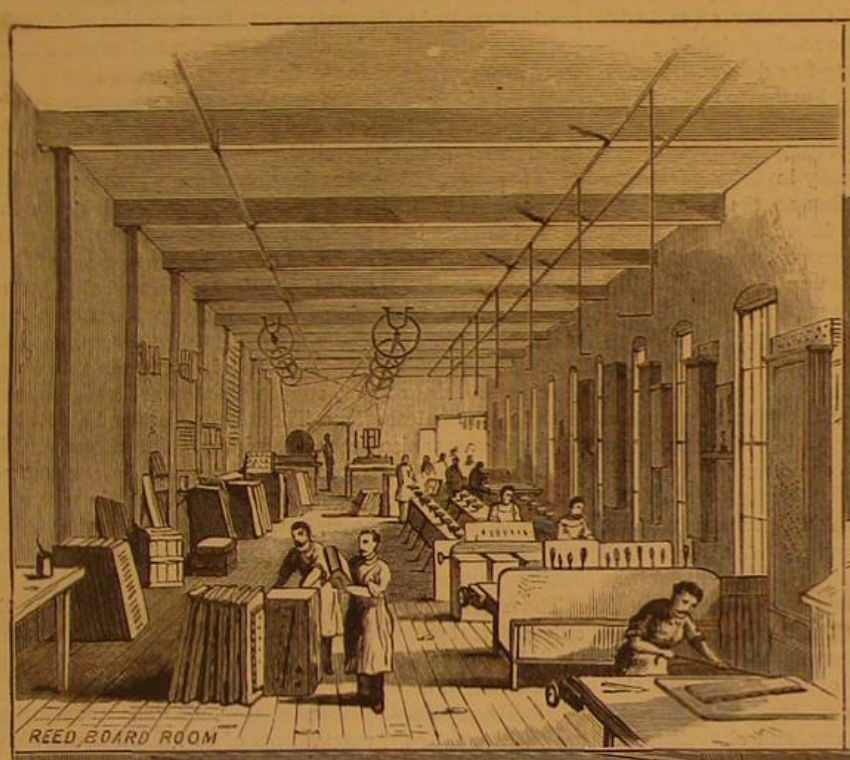

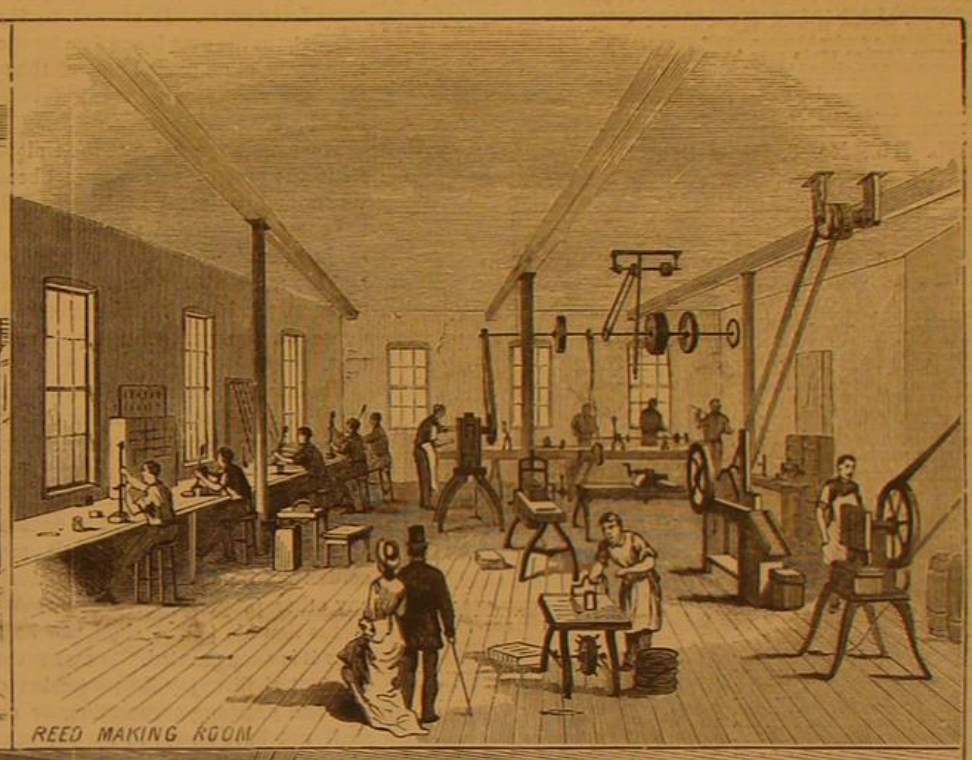

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THE NEW PATENT BILL.—SHALL IT PASS THE HOUSE?

In our last issue we recorded the fact of the passage by the Senate of the new patent bill (Senate Bill 300), which is now before the House of Representatives.

This bill, as we have on several occasions tried to show, is likely, if it becomes a law, to impair the future value of property in patents; and therefore it behooves all who wish to preserve the existing privileges of inventors to use their best influence with their Congressional representatives to defeat or set aside the measure. Whatever is done in this direction must be done quickly. Congress is to adjourn finally on the 4th of March, and the bill must either pass or suffer defeat by or before that day.

An esteemed correspondent writes us that he thinks it would not be difficult to defeat the bill if we would formulate specific instructions addressed to inventors and patentees, telling them how to band together to oppose the passage of the bill, specifying exactly what they ought to say to their representatives in Congress in order to induce them to give it their adverse votes.

Inventors, says our correspondent, are generally unlettered men, and although they feel strongly opposed to this attack on their interests, many of them do not know how to give proper expression to their views.

We suppose that what our correspondent desires is that now, in this closing hour of the contest, we shall briefly recapitulate the status of the present law and point out the scope of the intended substitute.

The present law, substantially, has been in operation for some forty years. It secures to the inventor an exclusive property in his own invention for the small period of seventeen years, at an official cost of thirty-five dollars. During this term no person may interfere with the patent without liability for infringement.

The existing practice of the United States Courts is to construe the present patent laws liberally in favor of the inventor and against the infringer. But on the other hand, the courts are careful to guard the interests of the public against the claims of unauthorized or pretended patentees; and the more widely a new device is wanted for public use, the more particular are the judges to require the clearest evidence on the part of the patentee in support of the patent.

The law, as it stands, as shown by the practice of the courts, provides ample safeguards for the public interests, as against untenable or wrongfully granted patents. The courts also regulate the measure of damages, so that even infringers are never overmuch punished.

At the same time it must be confessed that a patent as now granted means something. It means that a man shall actually own and control his patent, in his own way, like any other property, for the period of seventeen years. It means that his patent shall not be taxed out of existence after it is once granted. It means that a poor man who owns a patent shall enjoy the protection of the courts, and that rich and grasping corporations or combinations of interests shall not have power to harass, annoy, and altogether rob him of the fruits of his toil and ingenuity.

The amazing progress of the country during the past forty years is undeniably due to the fostering influence of the present patent laws. They have given impetus to manufactures, supplied thousands of new industries, and rendered the American name famous for industry and progress.

The present laws and practices of the courts have worked and are still working so well that it seems a great pity to change them, except as to such minor particulars where obvious corrections may require.

To boldly overthrow them and reverse, by legislation, the accustomed practice of the courts, seems to be suicidal. But this is what Senate Bill 300 seems designed to accomplish. It is the offspring of the combined efforts of the wealthy railway companies and other interests, who have become impatient to seize and appropriate to their own use every really valuable and important invention, without the customary formalities of payment or the owner's consent, as now by the law and the courts required.

Senate Bill 300 provides substantially, by section 2, that the patentee shall not for the future enjoy the full and exclusive right to control his patent; but anybody who desires may, by legal proceedings, which the inventor must defend, take the right from him.

It provides, by sections 3, 4, 5, 10, 11, that infringers may call the patentee into court and subject him to heavy costs and vexatious legal proceedings, so as practically to compel the inventor to deliver over his invention for the use of the infringers, thus reversing the present practice.

In short, the new law aims to punish the inventor and protect the infringer; whereas the present law aims to protect the inventor and punish the infringer.

Section 12 of the new law aims to tax the majority of patents out of existence after they have been issued, by requiring the inventor to pay a tax of $50 at the end of four years and $100 more in nine years, or in all $185 for the patent, instead of $35, as at present.

In our last number we gave a brief summary of the designs of all the sections of the bill, of which there are twenty-five; to which, and also to the several interesting discussions given by us week by week for a long time past, our readers are respectfully referred. We hope that every inventor and patentee who wishes to defeat this bill will make energetic use of the short time now remaining to assist members of the House in reaching the truth on the subject, and thus enable them to cast their votes intelligently.

CREOSOTED WOOD AS A PROTECTION AGAINST TEREDOES.

A series of experiments of great interest was some time ago undertaken by the Royal Academy of Sciences, of Amsterdam, to determine the best means of preserving wood from destruction by the teredo (*Teredo navalis*). The examination made by Mr. Harting (one of the commission of investigation), embodied in a recently issued report, is very instructive. It is ascertained that the mechanism of the mollusk is of a twofold nature. Those animals which are found in calcareous rocks make their excavations chemically through the agency of a dissolving acid secretion; but the teredo that perforates wood employs mechanical means only. The teredo appears to have existed at a geological period earlier than our own; this view being confirmed by the discovery of fossil wood perforated by a species of this mollusk in the Eocene formations. It has been discovered also that certain circumstances favor the increase and ravages of the animal; these being a moderate rainfall, an increase of the saltness of the water, and an increase of temperature. The experiments of the commission included processes that had been recommended to the government to protect marine works; and the pieces of wood experimented upon were allowed to be prepared by the inventors themselves. The ports of Flessingue, Harlingen, Stavoren, and Nieuwendam were selected first for the trials, the woods used being oak, red fir, common fir, and pine, in pieces about 3 feet long by about 12 inches square. By the side of these blocks other blocks of the same kind of wood were placed without any preparation, as counterproofs. The trials consisted (1) of coatings applied to the surface; (2) impregnation with different substances which modify the interior and exterior of the wood; (3) use of exotic woods.

All exterior applications—such as coal tar, paraffine varnish and Claasen's mixture of coal tar, resin, sulphur, and powdered glass—absolutely failed. A coat of mail consisting of nails is costly, and an examination of some piles proved that the coating of iron and rust was not proof against the ravages of the teredo in the interior. Sheets of iron, copper, or zinc are found effectual only as the surfaces remain intact and undamaged. Nature itself often affords a better protection than this in covering marine timber with barnacles or other shell fish. As to the second remedy—impregnation—the following substances all proved inefficacious and worthless: Sulphate of copper, copperas, acetate of lead, and mercurial and arsenical salts. The soluble glass and chloride of calcium process also proved powerless. Oil of paraffine injected into the blocks proved of no avail, as in about two years fully developed teredoes were found in all the pieces. Of the oil of creosote process, however, more favorable results are recorded—all of the woods prepared with this substance having been found intact.

The conclusions drawn by the commission are that the only effectual preservative is creosote, though in using it care should be taken that the oil is of good quality, the impregnation thorough, and that woods be used that will absorb the oil readily, as fir and other resinous woods. These conclusions are confirmed by the experiments of Mr. E. R. Andrews, of this country, who also has made interesting experiments with creosoted wood. A pine slab was taken, half of it was thoroughly impregnated with the oil, the other half being left untreated. It was then exposed during the season of 1877 in the waters of the Gulf of Mexico. When it was removed it was found that the creosoted portion was clearly and sharply defined by its darker color, and that it was perfectly sound, while the untreated half was riddled by teredoes, which had perforated it quite close to the edge of the creosote.

SKATING ON ARTIFICIAL ICE.

A skating rink, offering 16,000 square feet of artificial ice in one sheet, is in successful operation in this city. The projector, Mr. Rankin, is widely known in connection with the ice trade, particularly in the West and South, where his machines for producing ice are largely used. His present enterprise is notable chiefly for its magnitude, the area of ice produced being very many times larger than anything of the sort previously attempted. Something like nine miles of gas piping are required for the circulation of the refrigerating liquid, which is pumped through the pipes after having had its temperature sufficiently reduced in a freezing chamber some two hundred and fifty feet long, in which ice is liquefied by means of salt and other solids. The principle involved is simply that of the ice cream freezer. A tight floor was laid over a surface 200 feet by 80 feet; on this floor a network of pipes was laid, and the whole flooded by two or three inches of water. On pumping the refrigerating fluid through the pipes, the water is frozen and kept so cold that the surface of the ice remains dry, though the atmosphere of the rink is warmed by half a dozen large furnaces. The project might have been carried out equally well and much more profitably at midsummer, when a skating rink would have been more of a novelty. Mr. Rankin informs us that the temperature of the refrigerating liquid is raised but ten degrees while on its nine mile journey.

A NEW composition of iron and steel is described. A cast iron mould is divided into two sections by means of a transverse plate of thin sheet iron. The two metals are then poured into the respective compartments. The sheet iron partition prevents the mixture of the metals and facilitates the welding by itself being brought into a state of fusion. It is said that the product is well adapted for safes, and that it resists drills.

RECENT EXPERIMENTS WITH "LAUGHING GAS."

Protoxide of nitrogen, or "laughing gas," the anæsthetic properties of which were discovered by Sir Humphry Davy, is used at the present time by a very large number of dentists for producing insensibility during the process of extracting teeth. But this insensibility cannot be prolonged for any great length of time owing to the fact that asphyxia is liable to supervene. For this reason, American surgeon dentists have succeeded in performing lengthy operations by means of this gas, only in producing short, but repeated anæsthesia, separated by intervals of sensibility. The reason of this is that anæsthesia can only be produced by making the patient respire pure protoxide of nitrogen, without any admixture of air; the result is that asphyxia is a concomitant of anæsthesia. The celebrated physiologist, M. Paul Bert, has recently been experimenting on this subject with a view of discovering some means of overcoming the latter difficulty, and obtaining from laughing gas anæsthetic effects that may be indefinitely prolonged, while at the same time they shall be absolutely free from any dangers arising from asphyxia. The results of his investigations were presented in a paper read before the French Academy of Sciences on the 11th of November. It is proper to remark here that M. Bert's experiments were made upon animals solely. The fact that protoxide of nitrogen must be administered in a pure state signifies that the tension of this gas, in order that it may penetrate in sufficient quantity into the organism, must be equal to one atmosphere. In order to obtain it, under the normal pressure, it is necessary that the gas be in the proportion of 100 per cent. But if we suppose the patient placed in an apparatus where the pressure may be carried up to two atmospheres, we shall be able to submit him to the desired tension in making him respire a mixture of 50 per cent protoxide of nitrogen and 50 per cent air; we ought then to obtain anæsthesia, while at the same time we maintain the normal quantity of oxygen in the blood, and consequently preserve the normal conditions of respiration. And this is just what happens. In M. Bert's experiments he tells us that he entered an apparatus constructed for the purpose, and there under an increase of pressure of one fifth of an atmosphere he caused a dog to respire a mixture of five sixths of protoxide of nitrogen and one sixth oxygen—a mixture in which, as may be seen, the tension of the laughing gas is precisely equal to one atmosphere. Under such conditions the animal fell, in one or two minutes, into a complete state of anæsthesia, and had it not been for its respiration, which was executed with perfect regularity, it would have seemed to be dead. This state was found to last for an entire hour without the least change; the blood preserving its red color, the heart its regular beats, and the temperature its normal degree. During this whole period, all those phenomena of life called vegetative remained intact, while all those of animal life were absolutely annulled. When the bag containing the mixed gases was at length removed, the animal was observed, at the third or fourth inspiration of pure air, to suddenly recover its sensibility, will, intelligence, and natural friskiness. This rapid return to a normal state, so different from what is observed on the administration of chloroform, is due to the fact that laughing gas does not, like the latter, form chemical combinations in the organism, but is simply dissolved in the blood. As soon as none of it longer exists in the inspired air, it rapidly escapes from the system, through the lungs, as analyses of the blood have proved. As a result of many very careful experiments, M. Bert states that he feels himself authorized to maintain that the use of protoxide of hydrogen is perfectly harmless; and furthermore, he strongly recommends surgeons to use this gas under pressure, with a view of obtaining its anæsthetic effects as long as possible. By measuring, as above indicated, the barometric pressure and the centesimal composition of the mixture, so as to have for the protoxide of nitrogen the tension of the atmosphere, and for the oxygen at least the normal tension in the air, they will obtain a state of insensibility and a muscular resolution as complete as they desire, with an immediate return to sensibility and perfect state of well being, on removal of the anæsthetic agent. The sole difficulty in the way relates to the apparatus necessary to make the application of the anæsthetic under tension. For army purposes this is insuperable, but in cities the difficulty is easily remedied, for in such places compressed air baths are always obtainable, and in fact might be easily constructed in the surgical wards of hospitals at small expense. This, however, is a matter of secondary consequence, the solution of which remains with surgeons themselves; to whom, as well, it belongs to resolve the numerous questions of detail that always accompany the application of a new therapeutic agent.

A PAPER OBSERVATORY DOME.

An astronomical observatory has recently been erected for the Rensselaer Polytechnic Institute, at Troy, in the maturing of the plans for which Prof. Dascom Greene has introduced an improved method of constructing revolving domes. In making the preliminary inquiries, he ascertained that a dome of the required dimensions, constructed in any of the methods in common use, would weigh from 5 to 10 tons, and require the aid of cumbersome machinery to revolve it. It therefore occurred to him to have the framework made of wood of the greatest lightness consistent with the requisite strength, and to cover it with a paper of a quality similar to that used in the manufacture of paper boats; the advantages in the use of such materials being that they admit of great perfection of form and finish, and give extreme lightness, strength, and stiffness to the structure. A contract was accordingly made with a well-known firm of builders of paper boats, for the construction of the dome, and the undertaking has been carried out with great skill and success. The dome is a hemisphere, with an outside diameter of 29 feet. The framework is covered with paper about one-sixth of an inch thick after drying, and is of a superior quality, manufactured expressly for the purpose at Westfield, Mass.; it has a structure as compact as that of the hardest wood, which it greatly excels in strength, toughness, and freedom from any liability to fracture. The weight of the dome and its appurtenances, as completed, is about 4,000 pounds. It is supported on six 8-inch balls, which roll between grooved iron tracks, and can be easily revolved by a moderate pressure applied directly, without the aid of machinery.

THE WOODBURY PLANING MACHINE CASE.

At Boston, in the United States Circuit Court, January 28th, 1879, Judge Lowell rendered a decision in this important and long contested patent litigation. He decides that the Woodbury patent is invalid. A gigantic monopoly thus probably receives its death blow, for it is not likely that the Supreme Court will reverse the decision, though an appeal still lies to that tribunal. The enemies of our existing patent system who are claiming that the present rights of inventors shall be abridged, may see, from the principles laid down in this important decision, that the present laws as they stand afford the public ample security against the triumph of invalid patents or the progress of unauthorized patent monopolies.

The leading features of the Woodbury case, as found in Judge Lowell's decision, are as follows:

The patent was issued to Joseph P. Woodbury, April 29, 1873, and is for an improvement in planing machines, by which flat bars are placed before and behind the cutters to keep the stock firm during the operation, instead of the rollers, which were used by Woodworth, the inventor of this class of machines. This change, though slight, has proved to be of great value, and is now in general use; and this suit is defended by an association of persons who are interested to continue such use. The patentee is dead, and the plaintiffs are a corporation to whom he had assigned his patent.

The history of this grant, which was made twenty-five years after it was first applied for, and twenty-seven years after the invention was completed, is remarkable. The inventor made application June 3, 1848, and appointed an attorney, but did not give him all the usual authority. The power was so worded as not to enable him to withdraw the application. The office rejected the application February 20, 1849, and nothing further was done until October, 1852, when the attorney withdrew the application, and received back $20, of which Woodbury had no notice. In February, 1854, Woodbury instructed another solicitor to call up and prosecute this rejected application. There was, at that time, a rule in the patent office, that an application which should not be renewed or prosecuted within two years after it had been rejected or withdrawn, should be conclusively presumed to have been abandoned.

But in revising the patent laws in 1870, Congress enacted "that when an application for a patent has been rejected or withdrawn, prior to the passage of this act, the applicant shall have six months from the date of such passage to renew his application, or to file a new one; and if he omit to do either, his application shall be held to have been abandoned. Upon the hearing of such renewed applications, abandonment shall be considered as a question of fact."

Woodbury's application was thereafter revived, and after a long contest before the patent office, a patent was issued in the name of the inventor, dated under date of April 29, 1873. Meanwhile, the invention had for many years been brought into general public use, for as no patent existed all the lumber workers enjoyed the free use of the invention. The Woodbury party then began suits for damages against those who continued the use after the issue of the patent. Nothing could be collected for the use prior to the patent. The defense of Keith was, that Woodbury was not the original and first inventor, and, therefore, that the Woodbury patent was invalid. It was successfully shown that the machine built by one Anson, at Norwich, Connecticut, anticipated the invention of Woodbury.

The invention of Woodbury was made in 1846, and the machine of Anson was made in 1843. Of the date there is no doubt, for Anson applied for a patent on his invention in 1844. His machine was organized to mould or "stick," as the witnesses call it, sashes for windows, and similar articles, was adapted to planing, and was used for planing slats for blinds. There is no doubt that Anson's machine had bars instead of rollers, for he says so in his specification. The machine has been running ever since, and was produced in court.

"Two points," says Judge Lowell, "are taken against this machine. 1st. That the bed is not sufficiently solid to answer the purpose of Woodbury's bed, which is to resist firmly, like an anvil, as he says, the blows of the cutter. Upon the evidence, and upon inspection, I think the bed is a solid bed, within the meaning and use of the Woodbury machine, for all purposes of planing such stock as was likely to be planed upon it. And if the machine were to be enlarged to do general planing work, I see no reason to suppose that a similar bed, modified only as any mechanic would modify it, would not answer the purpose. The solid bed was not new with Woodbury, but was part of the Woodworth organization, which was the starting point of all these machines, and its benefits were well known and likely to be adopted by Anson. 2d. The other question is whether the bars which Anson made instead of rollers, had a yielding pressure. If not, they would not work on an ordinary planing machine, though they might possibly do in a small machine for special purposes. The machine in court has a yielding pressure, by means of weights, which allows the bar to give about three-eighths of an inch. Mr. Waters says about three-sixteenths of an inch: but he is considerably under the mark. To all appearance this organization is as old as the rest of the machine; but as the question of novelty on the part of Woodbury depends upon whether the weights were introduced thirty-five years or thirty-three years since, the appearance is of no great significance. The witnesses all think that the machine has remained unchanged in this particular from the beginning. It seems probably that any one who substituted bars for rollers would make them yield, because the rollers of Woodworth's machine were made in that way. It was not the yielding which was new, but the substitution of bars for rollers. The distinguished expert of the plaintiffs says, 'I have never seen a Woodworth planing machine organized with either rollers or bars to bear down the rough stock upon the bed-piece, by acting upon the rough surface of the stock, that was not so constructed as to allow the roller or bar, as the case might be, to yield to the inequalities almost always existing in sawed lumber; nor do I ever expect to see such a machine in practical use.' His meaning is, that the machine would stop whenever a board having the usual inequalities was attempted to be passed through it.

"In a machine like Anson's the difficulty might not present itself so often, or so soon, but I should suppose it would make itself felt sooner or later, and would need to be remedied before the machine had been run for a day.

"The witnesses, sixteen in number, are all on one side, and include, apparently, all persons now living who ought to be called. They testify from their recollection, with more or less positiveness, and with apparent fairness. None of them points to any change by which the pressure bars were made yielding after the machine was finished in 1843, but, as I before said, they all think them unchanged.

"Against this there is the evidence, which is entitled to much weight, that the drawings accompanying Anson's application for a patent do not show any opportunity for a yielding pressure, or but little. The model is somewhat damaged, and the suggestion is made that it may have been tampered with. As it appears to-day there is some play to the rods of the pressure bars.

"I do not think this negative evidence sufficient to discredit the recollection of the witnesses. The patent which Anson asked for had nothing to do with the bars, and there is no reason to suppose that he understood that there was any such advantage in bars over rollers as Woodbury saw and made known. He was not concerned with the particular matter of a yielding pressure bar; but if he made it to yield, he made the thing which Woodbury is, by a very proper and indeed necessary fiction of the patent law, presumed to have had knowledge of; and, therefore, when Woodbury pointed out the great advantage of this organization, he was merely, in intendment of law, applying an old machine to a more extensive use. I believe him to have been an original and meritorious inventor, but of a change which was not difficult to make or to invent, and of which, as it turns out, he was not the first inventor. Bill dismissed with costs."

A NEW AND IMPORTANT MINERAL.

About the first of December of last year, Dr. Henry Wurtz received a specimen of a newly discovered mineral, said to occur in considerable quantities in Utah, where it is found in veins of pipe clay. This mineral is of a dark brown color, and waxy feel, and is easily impressed by the finger nail. Dr. Wurtz made a preliminary examination, and found that it fuses at a little over 70° C., and evidently consists of a number of homologues of the paraffine series, such as those found in Europe in Moldavia and Galicia. It is the first deposit of the kind known on this continent, and may prove of great value to that section of the country.

Cold ether dissolves about 12 per cent of a soft paraffine of greasy consistence and having the color of burnt sienna. It becomes transparent on melting and resembles the urpethite of Johnston.

Boiling ether dissolves about 37 per cent, and leaves on evaporation a hard, waxy material, somewhat darker than the first portion. It is probably to be classed with ozokerite, notwithstanding its apparently greater hardness.

The third portion, insoluble in boiling ether, and comprising about 52 per cent of the original mass, is very dark brown and decidedly harder than beeswax. It appears to approach in character the Moldavian species of zietriskisite, but its melting point is somewhat lower. Lack of sufficient material has hitherto prevented Dr. Wurtz from determining the various points of interest with satisfactory precision.

C. F. K.

A recent number of the *Indian Tea Gazette* reports that a new species of tea shrub, resembling that which grows in China, has been discovered in Armenia, near Trebizond. The peasants pick the leaves and dry them in the sun, and large quantities have been sent to Persia, where the new product is highly appreciated

[Continued from first page.]

Prior to 1861, only a few reed instruments, known as seraphines, melodeons, etc., were made in America. In that year Messrs. Mason & Hamlin introduced important improvements, changing the form, improving the mechanism, and otherwise modifying the instrument, so that it was deemed worthy of the name which it has since borne. The improvement was so great that large popularity followed; sales rapidly increased, and numbers of other reed instruments ceased their manufacture, making organs instead. In numbering their instruments, Mason & Hamlin have already reached 103,000, having actually made and sold nearly this number.

In 1867 these makers, having taken highest honors at the more important industrial exhibitions in America, sent their new instrument to the World's Exhibition in Paris, placing it in comparison with instruments of the class from European makers. Its great merits were at once recognized; the jury awarded them the first medal, and even rival makers pronounced the Mason & Hamlin organ "worthy of imitation." At every one of the world's exhibitions since, Mason & Hamlin have boldly placed their organs in competition with the best similar productions of the world, and at every one have borne away the highest honors. At the Paris Exhibition of 1878 they received the only gold medal awarded to any American musical instruments, and, in addition, the highest co-laborer's medal.

And this suggests the fact that while their success as manufacturers is to be largely ascribed to the peculiar skill of those who have associated themselves in this company, which has enabled them to introduce so many improvements, it is in no small degree due, also, to the high standard which they set before themselves at the start, and to which they have rigidly adhered. Any mechanic who visits their factory will see evidence of the scrupulous selection of only best material, and the employment of every machine and facility for best work. The temptation to manufacturers during the last few years to lower their standard, and be satisfied with something less than the best, has been very great because of the strong competition in prices; and this has been especially the case in the manufacture of articles like organs, in which there is such abundant opportunity to cheapen. But the Mason & Hamlin Company have successfully resisted this temptation. The standard of their work is as high today as ever, and the excellence of their organs the makers state to be greater than ever before.

The New York office of this company is located at 25 Union Square; their factories are in Cambridgeport, Mass., virtually a part of Boston. Obviously we cannot represent in detail many of the various steps in the manufacture of these instruments.

The reeds, which are the most important part of the organ, are made from brass by the automatic machinery and mechanical appliances, shown in the upper right hand view in the title page engraving. Each reed consists of a block of brass having an oblong aperture, to which is fitted a tongue, secured to the block at one end, the other being left free to vibrate. The tongues of the reeds used by this company are secured by iron rivets, experience having shown that this mode of fastening is preferable to all others, the reeds secured in this way being less liable to loosen in the operation of voicing, or by long continued vibration. The shaping of the parts of a reed and the fastening of them together is comparatively a simple matter, as the greater portion of the work is done by presses and other machinery adapted to the purpose; but the voicing, as it is technically called, is quite a different matter. Here neither machinery nor mechanical appliances are of any avail, the success of the process being dependent chiefly upon a nicely trained musical ear. Voicing, which is the most difficult and important process in making an organ, consists in shaping the tongue of the reed so as to secure the best effects. This art was originated by Mr. Hamlin, of the Mason & Hamlin Organ Co., in 1848, and is now practiced, professedly at least, by all American and many European makers. It is an art that can be acquired by practice only, and it is found that but few are able to master it. The room in which the voicing is done is shown in Fig. 4. From this apartment extraneous noises must be excluded, otherwise slight defects in quality or timbre might not be discovered.

Each reed must vibrate in a cell of proper proportions, by which it is isolated from the others; these cells vary in size and form, according to the reeds which they are to receive, and are cut from the solid piece of wood which forms the reed board. The machinery employed in doing the work is shown in the left hand figure at the top of the front page engraving; it is of novel and ingenious character, and insures greater accuracy and uniformity than can be attained by handwork.

In the action rooms—one of which is the subject of the lower view on the front page—is made the apparatus which actuates the valves when the keys are depressed, a part of the

Fig. 4.—VOICING ROOM.

organs that must be delicate and yet strong, and very precise in its operation. In this department many ingenious machines are employed in forming the several parts, each of which is made absolutely perfect, so that when all of the pieces are assembled the completed action is as perfect as machinery and skilled artisans can make it.

The organ cases are made in the department illustrated in Fig. 5. The mode of manufacture is similar to that of furniture generally. This company have received much credit for the tasteful designs and excellent workmanship displayed in their organ cases.

Fig. 5.—CASE MAKING.

Progress of Petroleum.

The oil business for the year 1878 presents a great contrast with that of the preceding year. The year 1877 was marked by considerable and certain prosperity both to the refiner and the producer; while the year just closed has been one of exceedingly small margins and low prices.

The chief causes for the low price in the producing regions have been the increased certainty with which oil has been obtained and the extent of territory which has been developed during the year. The Bradford field has steadily increased in yield and importance, and almost all the old operators have become attracted there. The Bradford field at the beginning of the year yielded 8,750 barrels per day from 1,100 wells, and at the end of the year it yielded 23,700 barrels per day from 2,950 wells, showing a very marked increase in the activity of the operators, and an increase of 14,950 barrels in the daily yield. This increase more than compensated for the falling off in the production of all the other districts; and the aggregate yield of the year is in considerable excess of the aggregate production of the preceding year—showing 15,163,462 barrels against 13,135,671 barrels for the preceding year; an increase of 2,027,791 barrels during the year just closed. The daily average production was 41,543 barrels against 35,988 barrels. Thus it will be seen the production of the year 1878 was largely in excess of any year in the history of the trade. The prices of crude at the wells have ruled quite low, and with slight fluctuations have gradually declined during the year.

The stocks of crude have been considerably larger than those carried in any previous year, but they have been carried with greater ease than heretofore, as the tankage and pipe line facilities have been largely increased. The export of refined and crude (in the absence of the official figures we have estimated it as equivalent to 10,000,000 barrels of crude) compared with the exports of the previous year (which were equal to 10,425,502 barrels of crude) shows a decrease of 425,502 barrels. With the exception of London, the principal old European ports have taken considerably less oil this year than last; but the ports of China and the East Indies have more than doubled their receipts.

The number of producing wells in Pennsylvania at the close of December, 1878, was 10,337. The average production per well was 4·1 barrels.—*Stowell's Reporter.*

The Value of Practical Men.

In a recent lecture on electric lighting, Professor Tyndall took occasion to say a good word for inventors, practical men, who take up the results of purely scientific investigation and turn them to public advantage. Speaking of the problems involved in electric lighting, Professor Tyndall said that all the laws of the subject were known, and there was no room for a discovery in the scientific sense, but there was room for the application of such mechanical ingenuity as had given us the sewing machine, the phonograph, and many other things. The investigator and discoverer pursued his theme for the sake of gaining knowledge; the inventor's aim was generally to make money, though he gladly recognized that in many cases the inventor was stimulated by love of his art. Sometimes these men spoke disrespectfully of each other, as Cuvier despised the man of practical application, probably not taking into account that the application of science reacted on science.

The amelioration of the condition of the community was, at any rate, an object worth laboring for. Still, it was well to remember that those discoveries and applications which struck the public mind and excited so much discussion, often comfrom men whose sole stimulus was an intellectual one. As to the philosophic aspect of the question, there was a small cohort of social regenerators, men of high aims, and for whom he had great respect, who would hand over science and scientific men to a hierarchy which would determine the particular subjects that the scientific man ought to pursue. Where that hierarchy was to get its wisdom they never explained. Those writers denounced and scorned all reference to what they considered to lie far apart from human needs, and yet upon sensible conceptions—as of molecules, for instance—sometimes depended the greatest discoveries. When the feeble magneto-electric spark was first introduced, an Oxford don expressed his great regret that such a discovery should have been made; for, he said, it put a new and facile instrument in the hands of the incendiary. Let them imagine that hierarchy of which he had spoken watching Faraday piddling over his magnets. They would certainly have sent him back to the bookbinder's bench as a far more dignified occupation. Yet it was Faraday's spark that now shone, and which he hoped would illuminate our quays and halls, and esplanades and squares, and possibly also our homes.

RECENT AMERICAN PATENTS.

In engineering we notice an improved sectional boiler by R. Cosslett, Jr., of Bristol, England, which is composed of a number of inclined tubes having connections which alternate in position and insure a complete circulation.

An improved tube fastening for boilers, contrived so that the tubes may be readily inserted and removed, is the invention of Mr. W. H. Walsh, of Fort Worth, Texas. The device appears well calculated to strengthen the boiler.

A mining car truck, the invention of Messrs. W. McGaskill and J. Meinhard, of Virginia City, Nev., is provided with wheels which turn independently, and with self-lubricating axle boxes which exclude dust from the journals.

Among mechanical patents we find a cotton press, by Mr. J. J. Hines, of Savannah, Ga., which consists in a combination of two toggle joints, with a peculiar windlass arranged in relation to the platen, so that the power is advantageously applied to the cotton bale.

Among agricultural inventions we find an improved wheel cultivator by Mr. N. T. Remy, of Brookville, Ind., which is adjustable as to width, and is arranged so that either of the horses attached to the machine may draw in advance of the other without changing the direction of the machine.

Mr. Daniel C. Fosgate, of Rochester, Minn., has invented a sulky plow, the frame of which may be leveled and the plow adjusted by the driver while in his seat.

Another sulky plow, of novel design, devised by Mr. L. Brown, of Wartsburg, Washington Ter., has its plow supported at one side of the sulky, and is provided with a ready means of adjustment.

A new form of rotary churn, invented by Mr. John McAnespey, of Philadelphia, Pa., has its dasher bars so disposed as to render it very effective.

Mr. Thomas P. Williamson, of Golconda, Ill., has patented an Apparatus for Dividing or Colonizing Bees, consisting of two hives, each made in two sections, having vertical movable walls.

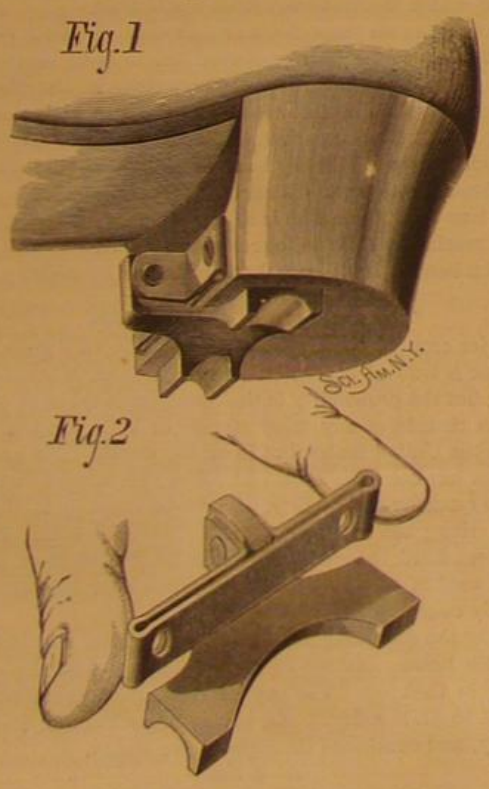
An improved Fence by Mr. Josiah H. Bailey, of Wilmington, Ohio, is cheap, strong, and durable, can be easily and quickly erected or removed. It consists partly of wood and partly of iron; wooden posts are avoided.

Mr. William A. Yeatts, of Little River, Va., has an improvement in Cutters in which the hay and straw are subjected to a shear cut by the reciprocation of the knife or knives in the arc of a circle; the knives cut at every stroke backward and forward.

Mr. J. K. Boswell, of St. Louis, Mo., has a device for heating, cooking, and for drying clothes or fruit. The apparatus has the appearance of a piece of ornamental cabinet furniture, the internal parts being made of metal and the outside of wood.

A NEW ICE CREEPER.

The desirability of an efficient ice creeper is admitted, but the amount of time consumed in attaching and detaching



AUSTIN'S ICE CREEPER.

creepers of the ordinary form is sufficient to prevent their general use.

The accompanying engraving shows an ice creeper that may be folded up against the sole of the boot when not in use, and may be readily unfolded so as to present four points to the surface of the ice.

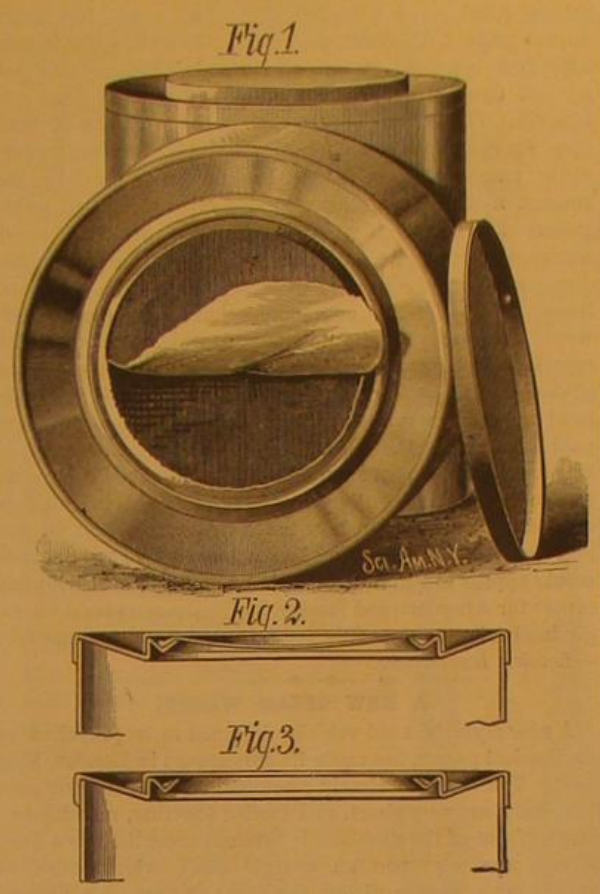
The invention consists in a strip of metal turned upon itself to form a spring, and bent outward, forming ears, between which is pivoted the right angled arm of the plate which carries the spurs.

When the device is in use it is arranged as shown in Fig. 1. When it is not in use the concave surface of the plate is folded up against the narrower portion of the shoe sole.

A patent for this invention was recently granted to Mr. Edward D. Austin, of Erie, Pa.

AN IMPROVED FRUIT CAN.

The improved can shown in the accompanying engraving is the invention of Mr. Edwin Norton, of Chicago, Ill. It is intended for the use of packers of canned goods, and afterward to be used by families, thus saving the cost of new cans, an important item when the amount of money annually expended for the ordinary wax sealing tin cans is considered. The cans used by packers can be used but once, as they are destroyed in opening.



NORTON'S FRUIT CAN.

This can has two caps, the inside one being made of thin tin, which may be readily punctured and cut when the can is opened, and it cuts out smoothly, so that the contents may be readily removed, and the can will be left in good condition for further use. The outer cap adheres by friction, and there is the usual wax groove common to such can tops, which permits of using wax or cement in sealing in the usual way.

For further information address Messrs. Norton Brothers, Chicago, Ill.

The St. Gothard Tunnel.

It has been held that the workings in the Nevada silver mines are the hottest in the world; nor is this remarkable, seeing that the said workings are driven in what may be termed the crust of a recent volcano. If the stories which reach us from the St. Gothard Tunnel be true, the heat in the heading must be even greater than that in the silver mines. The total length now bored is 13,500 yards from both ends. The workmen, we are told, are subjected to such a temperature that "they can wear no clothes whatever. They return to the mouth of the tunnel streaming with perspiration, their faces are yellow and ghastly, they cannot bear the light of the sun, they walk with bent shoulders, and stagger as if carrying burdens too heavy for their strength."

This seems to denote phenomena which deserve attention. In the Nevada mines the temperature is high for very good reasons. In deep mines it is high because the nearer we approach the center of the earth the hotter things get, for reasons not too well explained. But in the St. Gothard tunnel there is no approach to the center of the earth, and the constant escape of cold air from the perforators ought to make the place chilly, rather than the reverse. Can it be that a volcano may be tapped before the tunnel is finished? Speaking seriously, says the *Engineer*, there would appear to be some very great defect in the ventilating arrangements, in consequence of which the lights used exalt the temperature. If it can be shown that the heat is as great as it is said to be, the matter should be investigated by some competent authority, as the results of such an investigation may throw light on certain questions now very obscure.

Dangerous Houses.

Houses that have been empty may become fever breeders when they come to be re-occupied. An English sanitary officer alleges that he has observed typhoid, diphtheria, or other zymotic affections to arise under these circumstances. The cause is supposed to be in the disuse of cisterns, pipes, and drains, the processes of putrefaction going on in the impure air in them, the unobstructed access of this air to the house, while the closure of windows and doors effectually shuts out fresh air. Persons moving from the city to their country homes for the summer, should see that the drains and pipes are in perfect order, that the cellar and closets are cleared of rubbish, and the whole house thoroughly aired before occupying. Carbolic acid used freely in the cellar is a good and cheap disinfectant.

Aerial Telegraphy.

Professor Loomis, of Washington, according to the New York *Tribune*, appears to be still enthusiastically carrying on his experiments in aerial telegraphy in West Virginia. Aerial telegraphy is based on the theory that at certain elevations there is a natural electric current, by taking advantage of which wires may be wholly dispensed with. It is said that he has telegraphed as far as eleven miles by means of kites flown with copper wire. When the kites reached the same altitude or got into the same current, communication by means of an instrument similar to the Morse instrument was easy and perfect, but ceased as soon as one of the kites was lowered. He has built towers on two hills about twenty miles apart, and from the tops of them run up steel rods into the region of the electric current. The Professor announces that he has recently discovered that the telephone can be used for this method of communication as well as telegraphic instruments, and that of late he has done all his talking with his assistant, twenty miles away, by telephone, the connection being aerial only. He claims that he can telegraph across the sea without other wires than those necessary to reach the elevation of the current. There seems no immediate probability, however, of our getting on without poles and wire and ocean cables.

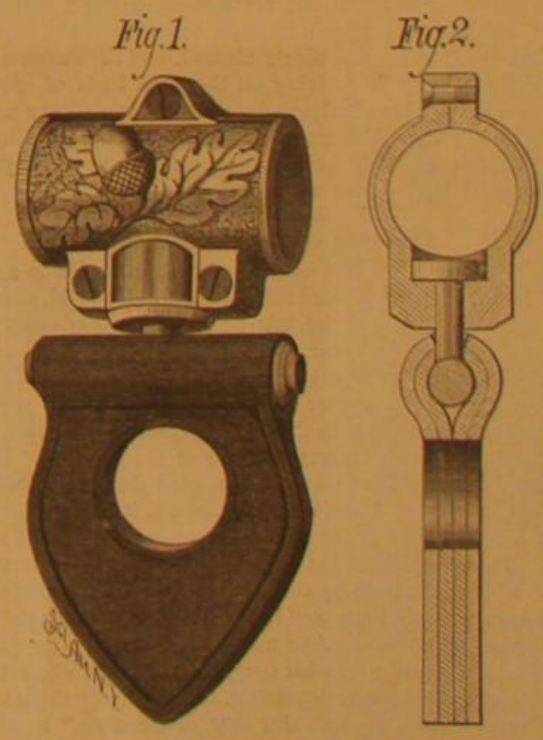
Explosion of Deflagrating Matter.

The author examines into the causes of an explosion by which a M. Zédé had been severely wounded. The latter was endeavoring to find a compound which without exploding should be entirely resolved at the lowest possible temperature into gases and vapors, and which should serve as a motive power. For this purpose he employed a mixture of gun cotton and of nitrate of ammonia. After finding the most suitable proportions he was studying in how far the speed of combustion, very slow in the open air, might be modified under increased pressure. On one occasion, when setting fire to the mixture contained in his apparatus, there occurred a violent explosion, attended by a flash of light. The tube, which had been tested up to fifty atmospheres, was shattered to pieces, and the experimentalist was seriously wounded. It would appear that a slight decrease in the orifice through which the gases escaped had changed the nature of the process from deflagration to detonation.—*M. Dupuy de Lome, in Comptes Rendus.*

AN IMPROVEMENT IN NECK YOKES.

The accompanying engravings represent in perspective and in section a novel neck yoke ring recently patented by Mr. Leopold Biddle, of Knoxville, Iowa.

The sleeve which encircles the neck yoke is made in two parts, fastened together by screws or rivets passed through the projecting ears. In one side of the sleeve there is a socket for receiving the head of a T-shaped iron, around which is placed the leather ring that encircles the pole; an iron or steel ring may be substituted for a leather one if desired, and the sleeve may be made of brass, bronze, or malleable iron.



BIDDLE'S NECK YOKE RING.

This device permits of all necessary movements of the neck yoke, and does not in any way detract from the strength of the yoke.

To Make Fabrics Impermeable to Water.

The Bavarian *Industrie und Gewerbe Blatt* says that M. Von Mallmann, of Paris, has recently taken out a patent for a new process of rendering any woven fabric impermeable to water without affecting its color or impeding the free passage of the air. The process consists in immersing the cloth in a bath composed of water, acetate of alumina, and Iceland moss. The latter article is first boiled in the water and the acetate of alumina afterward added. The fabric is allowed to remain in the solution two or three hours and then taken out and dried.

The Spring Outlook.

The *United States Economist and Dry Goods Reporter* of this city discovers, since the first of January, encouraging business prospects for the future. Values of all kinds of property have been adjusted to a specie basis, and the close of the first month of resumption finds more gold in the National Treasury than at its commencement, although $25,000,000 have been paid out therefrom. This fact sets at rest the doubts that croakers originated about the failure of the Treasury department to continue to pay gold on demand, and assures the public that honest money is once more triumphant. The excess of our exports over imports for the year 1878 exhibits the gratifying balance of $305,000,000, with every prospect of being further increased during 1879.

During the first three weeks of January, 1879, 9,000 packages of domestic goods have been exported in excess of the amount shipped from all other ports for the corresponding period of 1878. China, Japan, Mexico, and South America are cultivating with us closer commercial relations, and our cotton fabrics are finding in these countries a widely extended and rapidly growing market. Our breadstuffs and provisions are the chief articles of freight carried by the large fleet of steamers that almost daily leave our seaboard cities for European ports, and the shipments promise to assume such magnitude in the future that larger vessels of immense freight capacity are being constructed to accommodate this growing trade. The trunk lines of railway are being used to their full capacity in transporting the produce of the West to the seaboard, while the elevators in the chief cities of that region are crowded with grain waiting for cars to transport it East.

The recent large advance in railroad bonds and mortgages is an indication of the confidence felt by the public in their security as a permanent investment, while the rise in railway stocks also demonstrates clearly that the effects of the panic are rapidly disappearing, and that a new tide of prosperity awaits the country. Railroads were the first to feel the financial upheaval in 1873, and they also give the first sure indications of a commercial revival. Real estate is improving, and in this city vacant lots that could not have been sold at even a nominal price two years ago, have advanced in some cases 100 per cent within the last six months.

The great drygoods interest, which is larger than that of any other in the land, has before it an encouraging outlook. Prices of cotton and woolen fabrics, both foreign and domestic, are now so low that any change must be upward instead of downward. Merchants cannot lose by the wide fluctuation of values as heretofore. Incompetent and unsound concerns have generally been weeded out, a higher degree of mercantile efficiency and honor is being developed, and the business generally is passing under more systematic methods and control. There are 40,000,000 of people to be clothed, the chief portion of whom have made but limited purchases during the last five years, and now, with better times in view, will become large consumers of all kinds of merchandise. To the capitalist, banker, merchant, manufacturer, artisan, and laborer, there is the sign of a business improvement. It will be slow, but it will be steady and permanent. While Europe is threatened with social and commercial disasters, and distress and suffering prevail through declining trade, in the United States peace and plenty abound, and the business of the entire country is reviving on the solid basis of specie payments. We have had our disasters and trials; they multiplied for a time thick and fast; but having been led by a kind Providence safely through them, we enter upon a higher commercial destiny than we have ever known before.

American Goods at Sheffield.

Some time ago we had occasion to call attention to a report by Dr. Webster, United States Consul at Sheffield, touching upon the subject of the sale of American hardwares in the town whence he wrote. The same gentleman has now forwarded a further report to the State Department at Washington, the subject matter of which will, no doubt, prove exceedingly interesting to the manufacturers of the town, as well as to hardware traders throughout the country. The consul states that there was at first a good deal of prejudice against articles of American manufacture, it being alleged that, although they might do well for a time, they would not last. These suspicions, Dr. Webster says, have been proved to be wide of the truth by the testimony of large importers, who have not only done well in the past, but are now doing an increasing business. As a means of furthering the connection, the consul warns his compatriots not to allow the quality of their wares to depreciate, inasmuch as "sharp and intelligent critics are watching our productions," so that American exports must be kept up to the highest standard. Having thus admonished his friends across the Atlantic, Dr. Webster gladdens their hearts by saying that the English people, having been accustomed to articles of a heavy make, will use the American lighter wares if really good.

As an example of the favor which certain imported goods have found of late years, the writer of the report instances the case of American hay forks, which were originally distrusted as being wanting in strength, whereas at the present time they are very much liked. So, at least, Dr. Webster tells us, and he grounds his observations in part on the circumstance that one Sheffield firm has sold over 2,500 dozen of these forks this season, and could have disposed of even more had they possessed the stock. American scythes and scythe-snaths, too, are coming into use, and the worthy consul tells his countrymen that "a large trade in them is looked for next year."

Leaving these generalities, however, the report next deals with specific quantities, and we are shown some of the details of the business done by one firm alone at Sheffield in various American articles. The figures given are so suggestively significant that we reproduce them here for the benefit of those skeptics whose doubts can only be removed by statistical evidence. Says the consul: "The following are some of the articles and quantities sold, viz.: 2,145 dozen locks, 14,676 iron planes, 1,185 dozen boxwood rules, 2,952 dozen hat and coat hooks, 220 dozen hammers, 572 dozen weighing machines, 2,520 screw wrenches, 230 dozen saws, 600 dozen drawer pulls, 1,680 dozen auger bits, 753 axes, 4,000 braces, 2,800 fretwork saws, 20 tons oil stones, 2,400 dozen axle pulleys, 32 dozen scythes, 250 dozen snaths, rakes, glass cutters, etc. Other firms are engaged in the same line of business, the aggregate of whose sales would be several times the above amounts. One dealer has imported goods to the amount of £7,000, consisting, among other things, of locks, spokes and rims, hubs, brackets, augers and bits, bench screws, tailors' shears, sash fasteners, hammer and axle handles, planes, spoke shaves, wrenches, hay forks, axle and frame pulleys." The aggregate value of all these goods would necessarily amount to a very considerable sum, which represents not merely the loss to Sheffield of that value, but of double the total given, inasmuch as not only have the local manufacturers lost trade to that extent, but they have paid so much for the goods from other quarters. Facts of this formidable aspect should furnish ample food for cogitation in the steel and cutlery capital, and ought to cause inquiries to be made as to how the invasion can best be met and repelled. If something be not done pretty soon Sheffield would appear to run the risk of becoming a mere distributing center for American and foreign hardwares, and her own staple industries may possibly fall into comparative desuetude. —*London Ironmonger.*

A NEW STEAM WAGON.

A new style of road vehicle, designed to be propelled by mechanical power, has made its appearance in London, England. The carriage closely resembles an ordinary dog cart; the shafts are very short, and incline together, meeting two feet in front of the dashboard; between them there is a third wheel, working upon an upright shaft, which could be turned by a handle placed the same as that of a bicycle. this handle is worked by reins, in the hands of the driver.

NEW STEAM WAGON.

The motive power is obtained by the combustion of benzoline, a small jet of which is admitted into the burner. It is then set on fire, and is completely consumed by a current of air, which, until the machine is in action, is produced by turning the small handle already alluded to. The burner, about the size of an ordinary chimney pot hat, and quite as elegant, is lined by coils of a copper tube containing water; this tube is calculated to bear 2,000 lbs. on the square inch, and in working only receives 60 lbs.; so that practically it is not likely to burst, and, if such an accident did occur, the results would not be serious, as the whole tube only contains a pound of water. The steam generated in this tube passes at one end into the cylinders of a small torpedo engine, which rotates a horizontal shaft; it then passes into a cooler, where it is condensed by the effect of a current of cold air driven against the outside of the vessel by a revolving fan, and the water so produced is forced back into the other end of the tubular boiler by a force pump; hence there is not the slightest escape of steam, nor is there any smoke, as the benzoline is entirely consumed by the current of air. The revolving engine shaft works the driving shaft, not directly, but by the medium of two cones placed side by side, their bases being reversed in position. A figure of 8 band connects the two, and, as it is moved toward the base of one it nears the apex of the other, and thus increases or diminishes the speed of the driving shaft, which is connected with the driving wheel, or off wheel, by an endless band.—*London Field.*

American Cheese in England.

A Somersetshire dairyman, writing from England on American cheese, concludes his communication as follows: "It seems to me that unless there be some stir and a great improvement made in the general average make of our cheese, we must give up cheese making, and quietly allow the American, who is over 3,000 miles distant, has a more difficult climate to contend with, and the extra cost of boxes and carriage, to beat us out of our very boots. Let dairy farmers use their eyes, and they will find this persevering Yankee opponent pushing his cheese into every little shop both in our towns and villages, and even hawking them to our door, while we are holding our cheese because he sells a better and cheaper article. At two factors' stores in our neighborhood, where I saw the other day a pile of American cheese, I was told they were obliged to have them, as every one was inquiring for them, while my cheese, which I admit are not best, although better than a good many dairies, are not wanted."

American Goods in Australia.

The *Echo*, published at Sydney, tells the Australians that it is enough to set a reflective man thinking to see the almost universal use now being made, in almost every handicraft, of tools of American manufacture. The limit of ingenuity, says the editor, seems to have been reached in England. Such firms as Elkington & Co. are being entirely cast in the shade by the Tiffanies and similar firms of America. If there is any labor-saving, novel, ingenious instrument invented, from a sewing machine to a needle gun, ten to one but it comes from the fertile brain and skillful fashioning hand of some clever American inventor. To leave Edison's marvels alone, look at the wonderful machines now elaborated to save labor in agricultural work. The reaper and binder, and a host of others, will suggest themselves immediately. Our bushmen work with American axes, the very handles being of a new Yankee pattern. We ride in American buggies, lounge in American chairs, and get weighed in American weighing machines. American inventions for domestic purposes—from the washing, wringing, potato and apple paring, churning, and other housework machines, down to the latest dodge, a self-weighing cheese knife, are the wonder and delight of our housewives. In the workshop their marvelous self-adjusting planes, screws, chisels, and splendid tools of all kinds are entirely ousting the old-fashioned productions of Sheffield. It is high time technical education and schools of design were established, or Yankee ingenuity will entirely beat us out of the market. As one of their own writers puts it: "One of the principal reasons for the success of the American manufacturers abroad is the adaptability of American mechanics. They are not only thoroughly competent to make anything that is required, but they can also design tools for any conceivable purpose. They can make machinery for any work whatever, and they are always ready to learn. They do not think that theirs is the only way in which a thing can be done. It is the versatility of American mechanics that pushes their products on the foreign market."

Australian Competition.

At a recent meeting in Melbourne of the principal Australian meat preserving company, it was stated by Sir Samuel Wilson that the meat then in course of packing in the tins cost "a farthing less than nothing per sheep;" or, in other words, that the sums realized from the sale of the skins and tallow were sufficient to cover, or rather more than cover, the original prime cost of the animals. It follows that the cost of the tins in which the meat is packed, and the expenses attending its cooking and shipment, are the only charges which the preserved meat has to bear.

Commenting on these facts the *British Farmer's Gazette* remarks that "American preserved meats have lately been running the Australian produce very close in the English markets; but the invention of machinery which enables twenty-four tins to be packed in Melbourne in the same time in which one tin is filled by hand in Chicago ought to enable our colonial brethren to distance all competition."

Is it true that Melbourne is so far ahead of Chicago in the use of machinery? If so, our American inventors will have to lend a hand. It will not do to be beaten so easily.

The Ice Crop of the Hudson.

The ice crop of the Upper Mississippi is very great, and the same is true of other northern rivers from Minnesota to Maine; but the probability is that more ice is taken from the Hudson than from any other stream or body of water, not only in the United States, but in all the world. The harvest this year has been the most successful ever known, both as regards quantity and quality. The total capacity of the ice houses along the Hudson exceeds 2,000,000 tons. These have been filled to overflowing with ice of the finest kind, and upward of a million tons in addition have been stocked for early consumption.

During the gathering time over 10,000 men, nearly 2,000 boys, 900 horses, and 100 steam engines, were employed in getting in the crop. The pay of the harvesters has ranged from $1 to $1.75 a day. The season began the first week in January, and continued throughout the month.

Original Advice for Drinkers.

Barkeepers in this city pay on an average $2 per gallon for whisky. One gallon contains an average of sixty-five drinks, and at 10 cents a drink, the poor man pays $6.50 per gallon for his whisky. In other words, he pays $2 for the whisky and $4.50 to a man for handing it over the bar. Make your wife your barkeeper. Lend her two dollars to buy a gallon of whisky for a beginning, and every time you want a drink, go to her and pay 10 cents for it. By the time you have drunk a gallon she will have $6.50, or enough money to refund the $2 borrowed of you, to pay for another gallon of liquor, and have a balance of $2.50. She will be able to conduct future operations on her own capital, and when you become an inebriate, unable to support yourself, shunned and despised by all respectable persons, your wife will have enough money to keep you until you get ready to fill a drunkard's grave.—*Lecture of C. T. Campbell at Maysville, Ky.*

Car Drivers' Maladies.

While assistant sanitary inspector of the New York Board of Health, Dr. A. McLane Hamilton made a special study of the maladies incident to the work of street car drivers. The most common, though not the most serious, of car drivers' maladies was found to be chilblains, from which not one in ten of the Third Avenue drivers escaped. The car driver invariably stands at his work, and his feet and legs are inevitably chilled by inaction and exposure. The impeded circulation of the blood due to long standing brings on a train of symptoms to which chilblains are a trifle. Even in warm weather a few weeks' driving is almost sure to bring on a swelling of the legs, with persistent pains in the feet, followed by numbness in the legs and ultimately by partial paralysis.

The doctor finds two immediate causes for this lamentable state of things: first, the constant gravitation of the blood and other fluids to the lower extremities; second, the drivers' habit of standing with their weight thrown on their heels.

The result is, says Dr. Hamilton, that the perpetual jar and jolting of the car are transmitted by direct vibration along the bones of the leg and thigh to the spinal column that continues and rests on them. In the first stages of the disease resulting from this source the man becomes irritable and nervous without being able to assign any reason for it. A little later he has dull pains in the lumbar region, and an intolerable sense of weight in the legs. The immediate cause of these symptoms is congestion of the spinal cord and its meninges, the disease being, in point of fact, a species of meningitis that seldom proves fatal in itself, but is the precursor of other nervous maladies of a more serious complexion.

In the course of a pretty careful canvass among car drivers, to test the correctness of Dr. Hamilton's statements, a writer for the New York *Times* says that he found scarcely a single driver of five years' standing who did not confess to wearing bandages, or to being subject to very considerable inconvenience from the symptoms of varicosity and spinal irritation, and medical men who have the largest practice with people of this class, express doubts whether a car driver's average term of service exceeds seven years.

We are confident that it would be no difficult thing to devise a seat for car drivers, with a brake lever, so that they could drive and manage the car while sitting. With the utmost consideration the car drivers' position will be severe enough. It is sheer cruelty to subject them to needless discomforts.

Disinfection by Cold.

In a letter to the Congressional committee on the subject of epidemic diseases, having special reference to yellow fever, Mrs. Elizabeth Thompson states that the designs for a refrigerating steamer by Professor John Gamgee, of London, England, are far advanced at the Navy Yard, but it will require at least three months from the date of signing contracts to construct this life-saving ship and its machinery.

It is intended that this steamer shall proceed to New Orleans, as the port most threatened, and there try the effect of extreme cold in the disinfection of ships coming from infected ports. Mrs. Thompson says:

"The Board of Experts [authorized by Congress to investigate the yellow fever epidemic of 1878] declare that 'ships are especially dangerous,' and 'remain sources of infection for months after having been infected with the poison;' that 'yellow fever poison is not able to withstand the influence of frost, and when exposed to a freezing temperature it is rendered innocuous and is probably destroyed;' that 'if the apparatus and experiments now projected for the utilization of extreme cold for this purpose should be found to be of practical application to the disinfection of the holds and other parts of vessels, their success would prove to be a sanitary acquisition of inestimable value.'

"The losses to this country by yellow fever 'have been variously estimated at sums ranging from $100,000,000 to $200,000,000,' and it has been computed that New Orleans alone suffered to the extent of $15,335,000. Millions have been spent in ships of war, and I earnestly hope that the opportunity we now have of testing nature's great preventive for yellow fever—cold—may be taken advantage of with promptitude and liberality."

The experiment would seem to be worthy of a trial, and, properly conducted, would be comparatively inexpensive. In the hands of a practical Yankee an ordinary tug-boat could probably be fitted out with refrigerating apparatus sufficient to test the question inside of a fortnight.

Transmission of Power at Rock Island Arsenal.

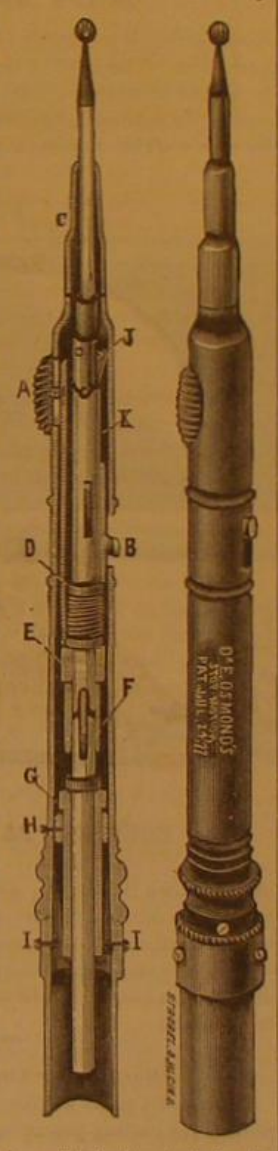
The experimental line of water power machinery with cable transmission, devised by Col. D. W. Flagler, for the Rock Island Arsenal, is said to work admirably. The full plans of Col. Flagler embrace 40 65-inch turbine wheels, working on two separate shafts, 20 wheels to a shaft. But now only four of these turbines are in place; the shaft is 9 inches in diameter, and 100 feet long. On the shore end of the shaft there is a driving pulley 15 feet in diameter, which receives a wire rope three fourths of an inch in diameter, which ascends to a tower and continues on to the shops. There are six spans of transmission, each span 400 feet in length, making the distance from the dam to the south row of shops 2,400 feet, almost a half mile. The ends of these spans are station towers of trestle work, each 40 feet high, these stations consisting of receiving and driving pulleys, each 15 feet in diameter. On one of the towers the cable turns at right angles by means of bevel gears. The four turbine wheels now being tested yield 240 horse power; and there was not a hitch in the whole length of the cable and machinery. This force will be used this winter for the shops. The great dams, the water power canal, and the minor parts of the work, have cost about $1,000,000. The pen stock is entirely of iron; and the turbines are so placed on the shaft that the stoppage of one by driftwood or otherwise will cause no derangement of the others.

The Adirondack Survey.

The reorganization of this survey, made necessary by legislative action last winter, has been successfully carried out; and the work accomplished during the past season is reported to be more than usually extensive and satisfactory. Many valuable scientific and geographical results have been obtained. A large number of the higher peaks have been measured with level and rod, and hundreds of miles of levels have been completed, covering the portions under survey with stations and permanent rock bench marks. The corners of counties have been marked, and county and town lines located. The chief rivers and lakes of the wilderness have also been surveyed throughout their whole extent.

STOP MOTION HAND PIECE FOR DENTAL ENGINES.

The advantage of being able to instantly stop the revolution of a dental burr, drill, or disk, must be obvious to every operator. Since the introduction of dental engines it is an easy matter to cut away the substance of the tooth so as to expose a nerve or unduly enlarge a cavity. To obviate such accidents, Dr. E. Osmond, of Cincinnati, O. (S. E. corner 8th and Elm streets), has perfected a stop motion hand piece for dental engines.



This instrument was recently patented and is now being brought to the notice of the dental profession. The hand piece is shown both in perspective and in section in the engraving.

The button, A, when pulled by bending the fore or middle finger, moves the arm, D, and the ring, E, which carries the clutch, F, downward out of engagement with the notched upper portion of the shaft, instantly breaking the connection and stopping the burr or drill. On removing the finger the parts regain their normal position and the drill is again set in motion. The instrument has a simple and effective drill holder, provided with a retaining spring, J, which may be exposed to view by drawing back the trigger, B. By pulling back the finger piece, A, and trigger, B, simultaneously, the drill may be changed while the engine runs.

Any of the well known dental engines may be used in connection with this instrument. Suitable means are provided for compensating for wear, and the finish is consistent with the use for which the tool is designed.

Chlorophyl as a Coloring for Preserved Vegetables.

At a recent meeting of the French Society to Encourage National Industry an important paper was presented by M. Personne on a process now being used in France for the preservation of vegetables in their natural green color, the process being based on the substitution of chlorophyl for the poisonous salts of copper formerly employed for this purpose.

The present process of preserving vegetables is that of Appert, made known at the beginning of this century. The industrial application of this process requires two operations, the first called washing, and the second, boiling. Washing consists in immersing the vegetables in boiling water for about five minutes, and then suddenly plunging them in cold water. Boiling is effected by placing the washed products in earthen vessels (or, better still, in hermetically sealed tin boxes) and exposing them to a temperature of 120° in steam boilers. It is readily seen that, after the operation, although the vegetables still retain their natural taste, they have lost their natural color and have become of a yellowish tint. The consumer, however, is not satisfied with the preservation of the taste alone; he also desires the additional satisfaction of having his eye pleased with the beautiful green color that the fresh vegetable possessed. As the export trade in these products is immense, it becomes absolutely necessary to accede to this demand, and so an artificial coloration has hitherto been effected by means of the salts of copper—principally the acetate and sulphate—added to the water in which the vegetables are washed. To the use of these metallic salts, however, there are many grave objections; and not the least of these is that of their poisonous nature. To find some means of doing away with the use of these toxic agents, by the substitution of some harmless matter, became the object of long and serious study to Professor Guillemore, of the University. He found at length, by experiment, that the less the quantity of chlorophyl in the vegetable the more rapidly and completely did it disappear on boiling; and that the fibers of the vegetable put in contact during boiling with soluble chlorophyl become saturated with it at a temperature of 100°; and finally, that the vegetables saturated with this chlorophyl, during the operation of washing, preserve and retain this color thereafter during boiling. After many experiments, the following has became the industrial process of fixing this chlorophyl coloring in a definite manner:

Spinach treated with a solution of soda gives up to the alkaline solution the chlorophyl, which it contains in large quantity; this alkaline solution is neutralized by hydrochloric acid added to the water in which the vegetables are to be washed. The chlorophyl, set free, unites with the vegetables, and this addition to the color which they naturally possess allows them to preserve their deep green tint, which otherwise would be destroyed by the boiling. The process, which is simplicity itself, has the immense advantage over the old one, that it introduces no injurious element into the preserved vegetables; indeed the products employed—chlorophyl and chloride of sodium—are such as make part of our daily food supply.

A Novel Temperance Society.

An association has been incorporated in this city, to be known as "The Business Men's Society for the Encouragement of Moderation." The purposes avowed by the society are to encourage moderation in the use of alcoholic beverages, to promote a knowledge of science and statistics relative to the manufacture and sale of alcoholic liquors, to disseminate among the people useful information regarding the principles of moderation and the means of carrying such principles into practical effect.

The society is also to exert its influence to induce retail liquor dealers to provide for teetotalers stimulating and nourishing beverages which contain no alcohol, and to encourage the establishment of places of cheap recreation and amusement where no intoxicating liquors shall be sold.

The pledges to be provided by this society are of three sorts: A total abstinence pledge, operative for one year, and renewable thereafter at the will of the pledger; a moderation pledge, binding the person who takes it not to drink during business hours; and finally, a unique engagement meant to prevent the person taking the pledge from partaking of intoxicating liquors at the expense of another person, and from extending an invitation to any other person to drink at his expense.

Utah Mineral Wax.

The great deposit of mineral wax, or native paraffine, lately discovered in Southern Utah, is described by Professor J. E. Clayton, of Salt Lake City, as occupying an area 60 miles long by 20 miles wide, and in some places forming a bed 20 feet thick. It contains more or less clay in seams and layers; but this is readily eliminated by melting, the earthy matter settling and leaving the paraffine nearly pure. It is quite black in the mass, but the sections are translucent. The quantity is said to be enormous; so great, indeed, that it cannot be controlled by any individual or company, but must prove a source of wealth to whole communities.

Professor Henry Wurtz pronounces the mineral to be zietriskisite, and says that it differs from paraffine by being insoluble in ether, and otherwise. Professor J. S. Newberry finds the specimens brought by him from Utah to be true ozokerite, and similar in all respects, except color, to that from Galicia; a true paraffine, melting at 60° C., and being soluble in ether.

As to the origin and geological relations of this remarkable bed of paraffine—which, so far as known, is without parallel in quantity in the world, and is as much of a "wonder" as our basins of petroleum—Professor Newberry cannot speak with any confidence until he has visited the locality where it occurs, as he hopes to do in a few weeks. He suspects, however, that it will be found to be an evolved product, the distillation of beds of cretaceous lignite, and the residue of a petroleum unusually rich in paraffine.

Coal Bunker Defenses.

The British naval authorities have been making experiments for some time with the view of testing the power of resistances to heavy shells of coals in the bunkers of men-of-war. The latest tests at Portsmouth seem to indicate that loose coal is the most effective means of protection yet discovered, and in the case of light, unarmored, or only partly armored vessels, the bunkers are built around the machinery. In the case of the Oberon it was proved by actual experiment that a shell from a sixty-four pounder at two hundred yards would neither penetrate the coal nor set it on fire.

High Temperatures.

By concentrating the electricity from a 13 horse power machine into the space of half an inch by inclosing carbon points in a block of lime, Mr. Edison claims to have produced the highest temperature ever reached by artificial means. When dropped into the flame, pieces of iridium, one of the most refractory of metals, volatilized immediately. A small screw driver passed across the flame would be cut in two, the part touched by the heat melting instantly. Even parts of the lime crucible fused under the intense heat.

AN IMPROVED PARALLEL RULER.

We give on this page an engraving of a novel parallel ruler recently patented by Mr. George Cousins, of Oswego, N. Y. It is intended for all of the purposes for which parallel rulers are commonly used, and in addition to this it may be used for duplicating designs, curves, etc.

The plate, A, which forms the body of the ruler, has formed in it two oppositely disposed segmental openings, whose straight sides form an angle of 45° with the beveled edges of the ruler. It has also several small circular apertures, which may be utilized in forming curved lines.

Parallel with one of the edges of the plate, A, a shaft, C, is journaled in suitable supports. On the ends of this shaft and outside of the bearings there are grooved wheels, D, which do not quite touch the surface on which the plate, A, rests.

To one of the wheels, D, is an arm, E, secured by the screw, F, as shown in Fig. 2, and in the groove of the same wheel there is a pin that strikes the stop which is secured to the plate, A, by the screw, I. This stop is arranged to engage the arm, E, also.

On the shaft, C, is placed a spiral spring, K, which returns the pin in the groove of the wheel to the stop on the plate, A, as indicated in Fig. 3.

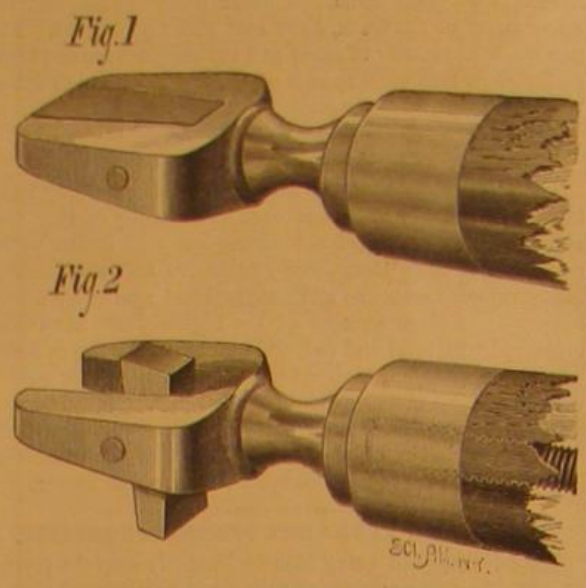
The side of the wheel, D, is graduated so that the arm, E, may be adjusted at any required distance from the pin in the groove. This distance governs the space between the lines formed along the edge of the ruler.

In drawing parallel lines the arm, E, having been adjusted as already described, the shaft, C, is pressed down until the wheels, D, touch the paper on which the lines are to be made; this tips up the beveled edge of the plate, A. The instrument is now moved forward, by rolling the milled portion of the shaft under the fingers, until the arm, E, strikes the stop on the plate, A, when the plate is allowed to regain its former position and the line is drawn. In drawing the successive lines the operation is repeated.

Section lining is done along the straight edges of the segmental openings, and curved lines are formed along the curved sides of the openings. Various designs may be duplicated by fastening patterns to the plate, A, so that they will move with it.

A NEW WHIFFLETREE HOOK.

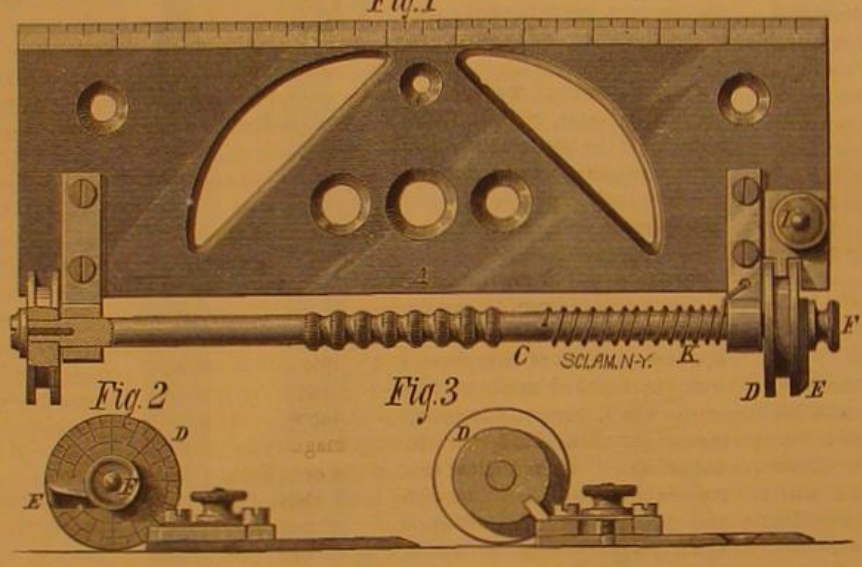
A novel and very simple device for securing traces to whiffletrees is shown in the accompanying engraving. Its



SMITH'S WHIFFLETREE HOOK.

construction is so clearly shown as to require very little explanation. The head of the pin in the end of the whiffletree is forked to receive a tapering tongue, whose pivot is arranged in relation to its center of gravity so that it will, by its own weight, assume a position at right angles with the pin as shown in Fig. 2. The trace is put upon the pin while the tongue is parallel with the head, as in Fig. 1; the tongue is afterward allowed to take the position shown in Fig. 2.

This invention was recently patented by Mr. Allen Smith, of Fort Randall, D. T., from whom further information may be obtained.



COUSINS' PARALLEL RULER.

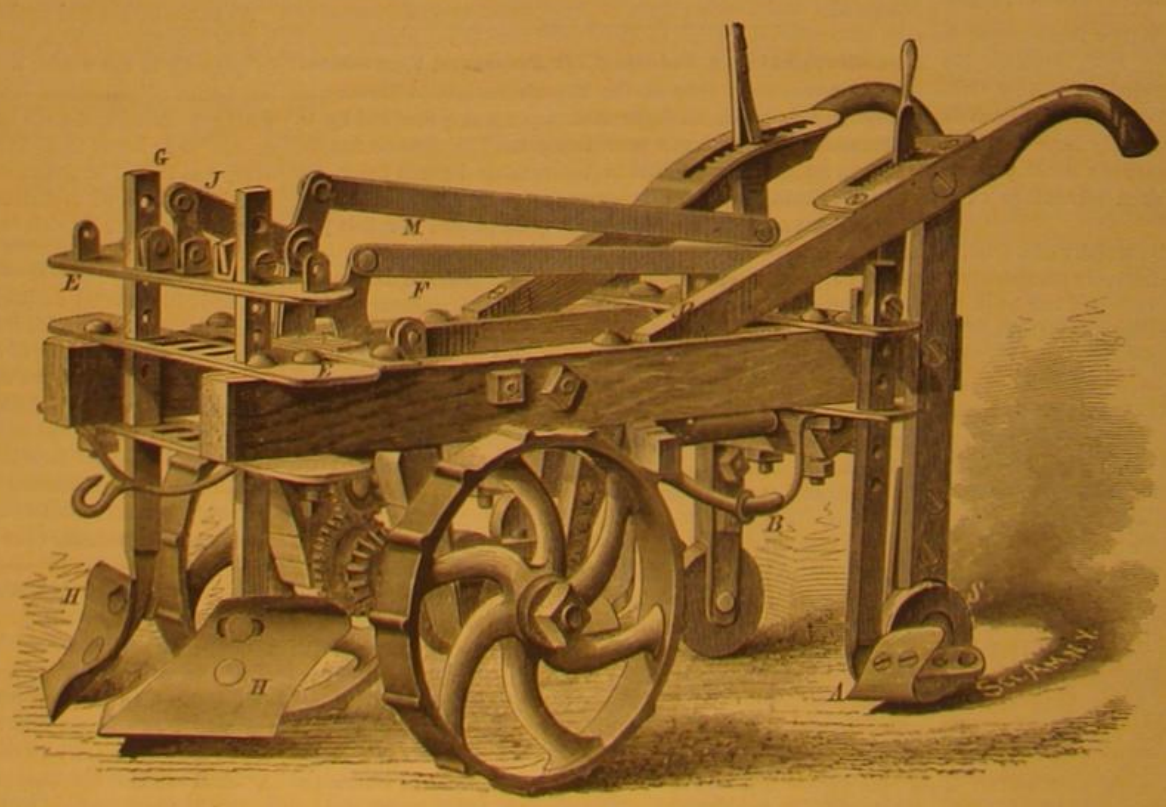
A COMBINED CHOPPER AND CULTIVATOR.

We give herewith an engraving of a new agricultural machine recently patented by Mr. John W. McMillan, of Brookhaven, Miss. This implement combines, in compact and usable form, a planter, chopper, cultivator, and a fertilizer distributer; in fact, it seems to be all that is required for the treatment of an entire cotton crop.

The machine, as will be noticed by referring to the engraving, carries two oppositely disposed plows, H, fixed to adjustable standards, G, guided by the plates, E, which are bolted to the forward end of the main frame. This frame is supported by two large wheels having corrugated or ribbed rims, and by two smaller wheels, S, which follow the small plows, A, at the rear of the machine. The standards are adjusted vertically by the hand lever at the rear of the machine through the rod, M, and angled lever, J. Behind the axle of the driving wheels there is a crank shaft which takes its motion through intermediate gearing from a bevel wheel on the axle.

This gearing may be thrown into and out of gear by means of the shorter lever at the rear of the machine, which communicates by a bar, F, with an angled lever connected with the movable portion of the gearing. The crank of the shaft referred to moves an arm, B, to which is attached a hoe whose motion is similar to that of the hand implement. The upper end of the hoe arm passes through a spring support, which allows the hoe to yield under undue strain.

Plows and hoes of different sizes and shapes, and colters, and harrow teeth may be attached. The plows may be adjusted laterally and vertically, and the various parts are adjustable to suit different kinds of work. It it stated that the machine will "flat-break" land, ridge up and bar off, scrape and chop out cotton, as well as the most experienced hand. It is capable of distributing from 10 lbs. to 1,000 lbs., of fertilizer to the acre, and will easily perform the several operations for which it is designed.



McMILLAN'S CHOPPER AND CULTIVATOR.

Phosphorus-Tin for Journal Boxes.

Ravene & Co., in Berlin, employ an alloy of tin and phosphorus for casting journal and axle boxes. It is easily fusible, melts at 330° C. (626° F.), does not heat at all when in use, and hence requires but little, if any, lubricator, and as it is scarcely at all affected by acids, cheap oils can be used. A great advantage is that no mould is required in which to cast it. The axle is placed in the box, which is closed with boards on each side and well stamped down with clay, and the metal poured directly into the mould thus formed. When cold the shell is taken out and cleaned, the oil hole bored, and it is ready for use. If not overheated this metal shrinks very little, if any, on cooling, and hence fills the mould most accurately, so that by using this metal instead of rough coating there is a saving of the cost for mould, for pattern, for boring out, and for fitting. It is said to last longer than other castings, will bear as great pressure and greater speed. The price in Berlin is, for No. 0, containing 5 per cent of phosphorus, $50 per 110 pounds; and for No. 1, containing 2½ per cent of phosphorus, $22.50 per 110 pounds.

The same alloy of phosphorus and tin is also employed for the manufacture of phosphorus bronze with great advantage both as regards cheapness and convenience, so that phosphorus bronze can be made in that manner with but little more expense than common bronze.

MISCELLANEOUS INVENTIONS.

Mr. William Vogan, of Newcastle, Pa., has an improved gate, which may be opened and closed by the wheels of a passing vehicle, and is not liable to become clogged or frozen fast.

A grain registering device for hand measures, which is contrived so that the act of "striking off" the surplus grain will ring a bell and operate the recording mechanism, is the invention of Mr. L. C. Ives, of Indian Creek, Va.

Mr. J. F. Christian, of Nurnberg, Germany, has devised a button having the head and shank formed of two separate pieces, which may be readily put together or separated.

An improved vehicle spring, which is adapted to the bolsters of wagons, and has several advantages over the ordinary spring, has been patented by Messrs. R. MacKeller and B. Lent, of Peekskill, N. Y.

An improved middlings separator, which purifies the middlings (driving off the dust and other impurities) and separates them into different grades, is the invention of Mr. W. P. Anthony, of Chambersburg, Pa.

An improved Pavement, formed of two courses of planks crossing each other at right angles, a layer of coal tar and sand, irregular bois d'arc blocks set on end with their interstices packed with sand, the whole covered with coal tar, has been patented by Mr. Samuel L. Shellenberger, of Denison, Texas.

A novel guide for matching machines, intended to prevent the planer knives from splitting the edges of the boards and to guard against the breaking of the knives, is the invention of Mr. P. Cardiff, of Marshfield, Oregon.

An improvement in brick machines, invented by Mr. J. McL. Mitchell, of Dunlap, Iowa, is contrived so that while pressure is exerted on one set of bricks, the bricks previously pressed are discharged from the moulds.

A novelty in gate rollers, the invention of Mr. William Schwendler, of Appleton, Wis., consists of a flanged roller fitted to a screw pin by a ball joint, so that it may turn on its axis and also swing like a hinge.

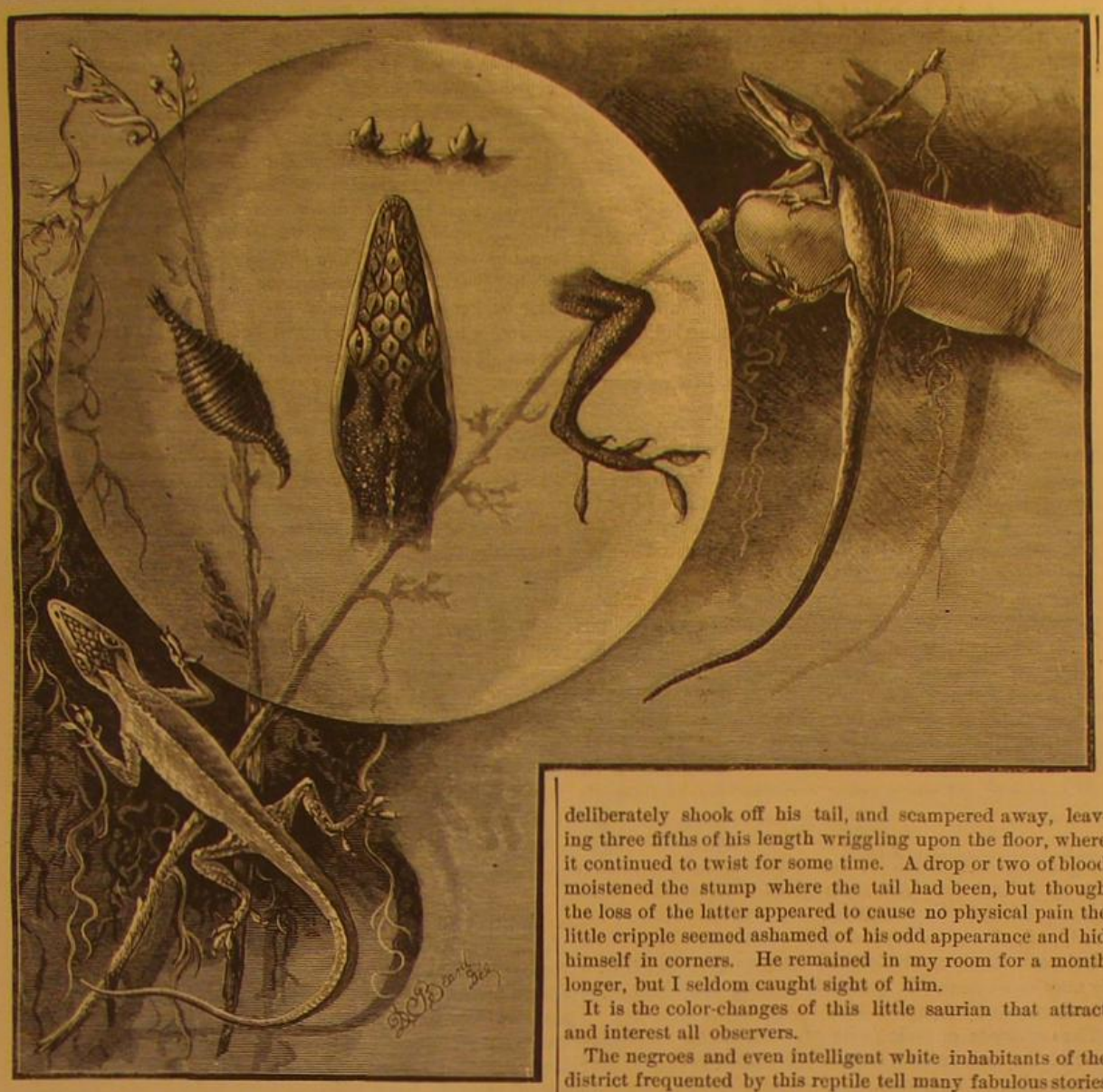
A shuttle box motion for looms, in which springs are dispensed with, and an easy and sure movement is secured, is the invention of Mr. John Barker, of Whittenton (Taunton P.O.), Mass.

Mr. J. A. Novinger, of New Bedford, O., has an improvement in gravitating platform animal traps, which insures a renewal of the bait after each operation of the trap.

An improvement in reefing fore and aft sails, by Mr. J. L. Dickenson, of Hempstead, N. Y., saves time and labor in reefing, and brings the sail into proper shape for a storm sail. It has the advantages of a try sail, and insures the security of the gaff when the vessel rolls.

Mr. Valentine Cook, of New York city, has an improvement in beer coolers. The main feature of the invention is the device for strengthening the large shallow pans used in the process of beer cooling.

A sight for firearms, which combines the advantages of the different sights in general use, has been patented by Mr. W. Matthews, of Camp Bidwell, Cal.



GREEN CAROLINA ANOLIS; OR, THE AMERICAN CHAMELEON.

BY DANIEL C. BEARD.

Perhaps the first creature that attracts the eye of the Northern naturalist upon landing at Florida is a small, slender lizard, which appears omnipresent, to be seen running up and down the walls of the Old Fort at St. Augustine, peering in at the windows of the hotel at Pilatka, scampering over the logs of the swamp at Tocoi, or scrambling along the garden fences at Jacksonville. It may also be seen exhibited for sale along with young alligators, wildcats, black bears, and many other queer objects to be found in the jewelry stores at Jacksonville.

The specimen from which my illustrations are made I captured at Tocoi. When first taken he was of a sooty black; five minutes afterward, when I opened the handkerchief in which I was carrying him to show my prize to a friend, I was amazed to find, in the place of the dark, dingy little creature I had wrapped up, a beautiful emerald-green lizard. It was only then that I discovered my specimen to be the so-called American chameleon. I was somewhat ashamed of my ignorance until I met a certain naturalist from Michigan, who had made quite a collection of what he took to be distinct species of saurians, and had carefully preserved them in spirits, only to find upon inspection, that they were all exactly alike in form and color, all having assumed a yellowish-brown tint after immersion in alcohol. Two anoli that I kept in captivity proved very gentle pets, and would run over my hands waiting eagerly for me to catch flies for them. Although quick in their movements, and able by the help of their tail to spring quite a distance, these little animals never could capture the flies for themselves unless I first crippled the insect by removing a wing. They loved the sunshine and fresh air; the latter they would swallow occasionally in great gulps, expanding a sort of pouch under their neck by the process. Though gentle when treated with kindness, when tormented they would show fight, opening their mouths in a ludicrous way. One, after trying in vain to bite a lead pencil, with which I had been stroking his back and otherwise plaguing him, deliberately shook off his tail, and scampered away, leaving three fifths of his length wriggling upon the floor, where it continued to twist for some time. A drop or two of blood moistened the stump where the tail had been, but though the loss of the latter appeared to cause no physical pain the little cripple seemed ashamed of his odd appearance and hid himself in corners. He remained in my room for a month longer, but I seldom caught sight of him.

It is the color-changes of this little saurian that attract and interest all observers.

The negroes and even intelligent white inhabitants of the district frequented by this reptile tell many fabulous stories of its wonderful powers in this respect. Experiments with specimens which were in my possession at different times seemed to demonstrate that emerald green, gray, and sooty black and reddish yellow were the limits of its power. When frightened or pleased it turned green; if agitated for some time in apparent indecision, the color would fade and return in blotches. Under an ordinary magnifying glass it could be seen that the hollow around the eye changed first. Then the hexagonal plates upon the head showed the color, commencing at the edges and gradually spreading over each plate, the centers being the last points to turn. If a number of these animals be placed in alcohol they will be found to assume a dirty yellow or brown tinge. This is probably the natural hue of the skin with the coloring matter removed. The pigments appear to be contained in a network of vessels beneath the skin, and to be somewhat, though not altogether, under control of the animal. One, placed upon a bright crimson cloth, assumed a reddish yellow color, and though it did not approach the brightness of the cloth, a casual observer would hardly have noticed the lizard motionless upon it.

Green is its favorite color, and black I never saw but in one instance. When hiding in the Spanish moss or upon a tree trunk it assimilates the gray, while yellowish red it assumes with apparent effort. When put and left upon a red substance or in a cigar box, the color of the latter it approaches very nearly. From tip of nose to tip of tail measures from five to six inches, the tail being three fifths of its total length. The head is rather large, triangular in shape, apex at the nose, and covered with small hexagonal plates from the nose to just behind the eyes. The rest of the body is covered with small papillous points; the nostrils are near apex of the nose; the animal has no apparent external ears; it has bright, intelligent, almond-shaped eyes; large mouth, ten well defined teeth upon each side of the upper jaw, and four well defined teeth in the lower jaw, the intermediate space being filled with minute points; and four well developed legs, five toes upon each, each toe swelling out into a soft pad, terminating in a hooked claw. The pad or middle of the toe, under the magnifying glass, shows an odd arrangement of folds or flounces in the skin, each flounce, tuck, or fold being armed upon its edge with minute points, one half of them pointing up and the other half down, as shown in the illustration. Thus may we explain the creature's ability to run up or down the side of a house with equal facility.

In the illustration I have shown the lizard upon my finger, with mouth open; the dark color representing its favorite green hue. At the bottom in the moss is the same animal in his gray coat. In the circle appears a magnified view of the teeth, the second toe of the hind foot much enlarged, showing the peculiar arrangement of the folds of the skin upon the under side, and an enlarged view of the hind leg, and the head as it appeared under the glass while changing its color.

A NEW TORPEDO BOAT.

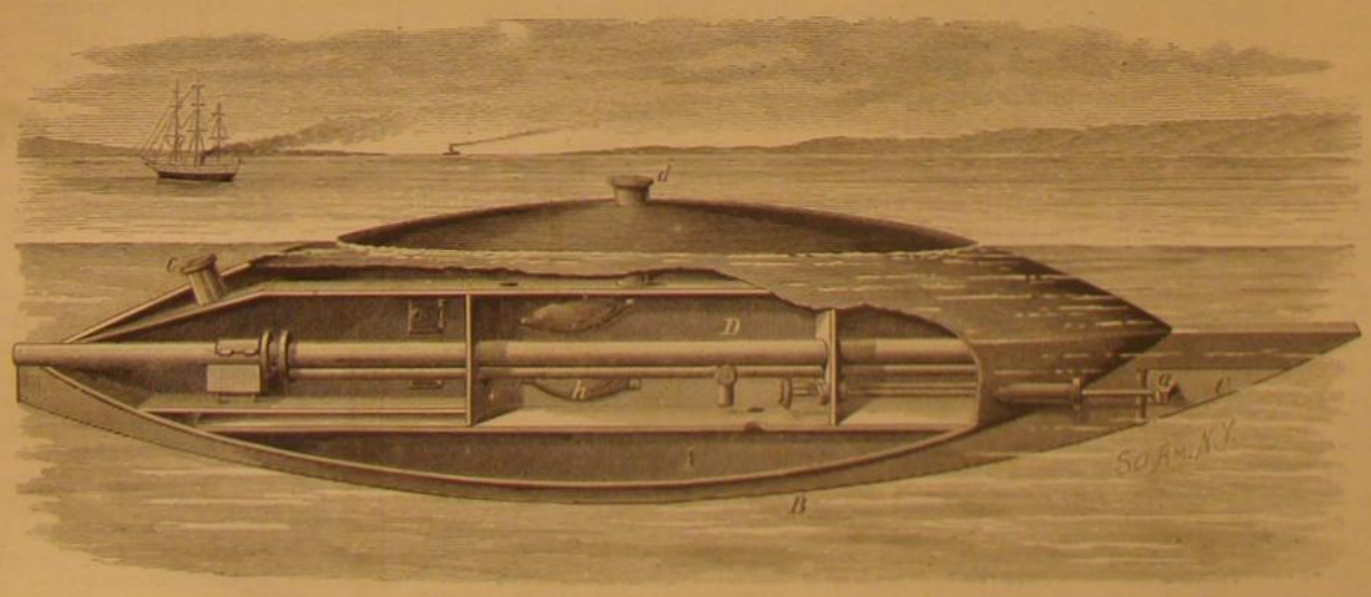
The accompanying engraving represents partly in section a torpedo boat recently patented by Mr. H. Mortensen, of Leadville, Col. The hull A, of the boat, has an arc-shaped keel, B, that runs the entire length, and projects beyond the stern. A portion of the keel is cut away at the stern to receive the rudder, C, which is pivoted in the support thus formed, and is provided with two arms, *a*, one on each side, that project at right angles to the face of the rudder, to receive the thrusts of the screw rods, which project through the stern of the boat, one on each side of the keel. The hull is divided into several compartments, one of which is designed to contain the men that operate the torpedo-projecting mechanism, another contains the men who introduce the torpedo into the projecting apparatus and attach it to the movable rod, and there are compartments for containing either air or water, as occasion may require. In the upper part of the boat there is a chamber which contains compressed air for the supply of the crew and for working the machinery. Under the several compartments already mentioned, there is a compartment for containing water forced in against an air cushion. This chamber acts as an accumulator of power which is expended in working the torpedo projecting apparatus.

A cylinder containing a piston is placed longitudinally in the hull, and provided with a loading chamber which projects through the bow of the boat.

The water required for working the piston may be forced into the accumulator chamber before the boat is started, or it may be forced in by hand or otherwise while the boat is under way.

The rods by which the rudder is operated are threaded, one being provided with a right hand and the other with a left hand thread, and work in fixed nuts, and are provided with driving mechanism operated by a suitable motor or by hand.

The boat has a removable upper portion, which is secured to the hull by means of bolts. The top is comparted in the same manner as the hull, and both top and hull are provided with valves for the admission and escape of air and water. In the top there are two entrances, *c d*, provided with hinged covers that are packed to render them watertight.



MORTENSEN'S TORPEDO BOAT.

The compartments for containing the crew are provided with windows, which open inwardly, so that they may be repaired or replaced in case of breakage.

In each side of the boat there are recesses inclined in opposite directions; each of these recesses contains a screw propeller, the shaft of which extends into the boat, and is connected with a motor. By means of these screws the boat may be propelled forward or backward, and raised or lowered, as may be required.

The boat is capable of being operated wholly under the water; or the top portion may be removed, when it may be propelled on the surface.

Development of the Lizard.

At a recent meeting of the Royal Society Prof. K. Parker presented a communication embodying part of his work on the structure and development of the skulls in the lizard group. His researches on the embryos of the common British lizards have led him to very unexpected results. Hitherto we have been accustomed to regard the crocodiles and

turtles as the highest groups of the reptile family, chiefly on the evidence of the structure of the soft and more important vital organs. But the evidence from the skull leads Prof. Parker to regard the lizards not only as the most highly specialized of reptiles, but the group which approaches most closely towards birds. The term "lizard" is, however, at present used so vaguely as to include the hatteria of New Zealand and chameleon, both of which are often regarded as types of distinct orders of reptiles. The chameleon, however, which in many respects approximates toward crocodiles, is regarded as the lowest of the lizards, and even more distant from the higher types than tortoises and turtles. Yet the lizard skull is found to be but slightly modified from that of the snake. On the whole the character of their skulls leads to the conclusion that birds differ less from lizards in structure than does the ordinary perfect insect from its pupa. Of old the strong resemblance which the lizards termed "blind worms" present to serpents led to the conclusion that we see in them the limbs first coming into existence, but Prof. Parker not only regards the serpent as the more ancient and more generalized animal, but also as one which shows evidence of its degradation by the loss of limbs, which he believes the ancestral forms of the serpent types possessed. Of late years it has been customary to attach great importance in classification to the modification as presented by the ear bones. Judged by this standard the lizard is closely related to the tortoise and crocodile, and all three types are regarded as differing but little from the bird in this respect. The snake, however, is of a lower grade in the structure of the ear, while this feature in the chameleon is even less specialized than in frogs and toads. As concerns the theory of the skeleton and of the skull, Prof. Parker is led by his researches to conclude that the skull was the part of the animal first formed. Subsequently the joints of the backbone came in successive generations into existence, while the limbs and the bones which support them were of more recent origin than the trunk. From the indications furnished by development of the embryo there is reason to believe that some of the lower vertebrates had a long head, including as many as 14 or 15 divisions, which succeeded one another in a line from the front backward, and from this, as well as from the supposed comparatively late origin of the backbone, Prof. Parker is led to describe as absurd the well known "vertebral theory of the skull," originated both by Goethe and by Oken, and elaborated by Owen. Another important conclusion of Prof. Parker's, based chiefly on the researches of Mr. Balfour, is that the neck comes into existence by a long series of evolutions as a result of the subdivisions of the second vertebra, and serves "to bind the shortening head to the retreating body." In conclusion Prof. Parker expresses his opinion that even those who are content to work at the development of the lowlier types, such as the worm and the crayfish, are helping to throw light on the solution of the vertebrates.

Photography on Wood.

BY PROFESSOR J. HUSNIK.

I adopted the method of exposing gelatinized paper alone under a negative, and when the chromium salt had been washed out, placing it on a plate of glass and laying on the ink with a very small glue roller. With this I succeeded completely; I obtained beautiful pictures, perfect in the half tones, which could be at once laid on the wood block, and be printed off at one impression. Gelatine paper can be easily prepared, and kept in stock, according to the process described in my book *Das Gesammtgebiet des Lichtdrucks*, by placing sheets of paper in a perfectly horizontal position, and coating them with a dilute solution of gelatine, and they need only be sensitized at the moment of use with a one per cent solution of chromate; by this means the above described method is rendered thoroughly simple and practical, as well as being certain in its results. The wood block itself requires a very simple preparation; it must be rubbed down with whiting to which some adhesive substance has been added. This rubbing can be best effected by the ball of the hand. Gelatine paper can also be purchased from the dealers, and even my own photo-lithographic transfer paper will answer the purpose very well, provided that, before immersing it in the chromate solution, it be wiped over a few times with a damp sponge, and then rinsed well in clean water. This is done to remove any soluble matter from the surface. Afterwards the paper is dipped for some minutes in a one per cent solution of chromate, then drained, and hung up to dry at an ordinary temperature. Sensitized in this way it remains good for the above named purpose for from three to five days.

The Manufacture of Glass in Pittsburg.

Pittsburg, Pa., produces more than half the glass made in the United States. Its factories number 73, with 690 pots, and give employment to 5,248 hands, whose wages approach $3,000,000 a year. The materials employed in the manufacture were, the past year, 12,110 tons soda ash, 48,340 tons of sand, 152,000 bushels of lime, 1,218 tons nitrate soda, 793,500 bushels of coke, 4,525,760 bushels of coal, 4,025 cords wood, 6,055 tons of straw, 2,760 barrels of salt, 250 tons pearl ash, 360 tons of lead, 150,000 fire brick, 2,955 tons of German clay. The packing boxes cost $484,250, and required 2,109 kegs of nails. 96 wagons and 130 horses were employed in hauling. The space occupied by the buildings is equal to 208 acres, and the capital in buildings, machinery, and grounds is, in round numbers, $3,500,000. The business produces about $7,000,000 a year.

Memoranda for Garment Dyers.—Substances and Reagents Suitable for Removing Spots.

Steam has the property of softening fatty matters, and thus facilitating their removal by reagents.

Sulphuric acid may be employed in certain cases, especially to brighten and raise greens, reds, and yellows; but it must be diluted with at least 100 times its weight of water and more, according to the delicacy of the shades.

Muriatic acid is used with success for removing spots of ink and iron mould upon a great number of colors which it does not sensibly affect.

Sulphurous acid is only used for bleaching undyed goods, straw hats, etc., and for removing fruit stains upon white woolen and silk tissues. The fumes of burning sulphur are also employed for this object, but the liquid acid (or a solution of the bisulphite—not bisulphate—of soda or magnesia) is safer.

Oxalic acid serves for removing spots of ink and iron and the residues of mud spots, which do not yield to other cleansing agents. It may also be employed for destroying the stains of fruits and of astringent juices, and stains of urine which have become old upon any tissue. Nevertheless, it is best confined to undyed goods, as it attacks not merely fugitive colors, but certain of the lighter fast colors. The best method of applying it is to dissolve it in cold or lukewarm water, and to let a little of the solution remain upon the spot before rubbing it with the hands.

Citric acid serves to revive and raise certain colors, especially greens and yellows; it destroys the effect of alkalies and any bluish or crimson spots which appear upon scarlets. In its stead acetic acid may be employed.

Liquid ammonia, formerly called volatile alkali, is the most energetic and useful agent employed for cleaning tissues and silk hats, and for quickly neutralizing the effects of acids. In the latter case it is often sufficient to expose the goods to the fumes of this alkali in order to remove such spots entirely. Ammonia gives a violet cast to all shades produced with cochineal, lac, the redwoods or logwood, and all colors topped with cochineal. It does not deteriorate silks, but at elevated temperatures it perceptibly attacks woolens. It serves to restore the black upon silks damaged by damp.

The carbonate of soda (soda crystals) serves equally in most of the cases where ammonia is employed. It is good for hats affected by sweat.

Soda and potash only serve for white goods, of linen, hemp, or cotton; for these alkalies attack colors and injure the tenacity and suppleness of woolen and silk. For the same reason white soap is only to be recommended for cleaning white woolen tissues.

Mottled soaps serve for cleaning heavy stuffs of woolen or cotton, such as quilts; for such articles which do not require great suppleness or softness of feel the action of the soap may be enhanced by the addition of a small quantity of potash.

Soft potash soaps may be usefully employed in solution, along with gum arabic or other mucilaginous matters, for cleaning dyed goods, and especially self colored silks. This composition is preferable to white or marbled soaps, as it removes the spots better, and attacks the colors much less.

Ox-gall, which can be obtained from the butchers in a sort of membranous bag (the so-called gall bladder), has the property of dissolving the majority of fatty bodies without injuring either the color or the fiber. It may be used preferably to soap for cleaning woolens; but it should not be employed for cleaning stuffs of light and delicate colors, which it may spoil by giving them a greenish yellow, or even a deep green tint. It is mixed also with other matters, such as oil of turpentine, alcohol, honey, yolk of egg, clay, (fuller's earth), etc., and in this state it is used for cleaning silks.

To obtain a satisfactory result gall ought to be very fresh. To preserve it a simple method is to tie the neck of the gall bladder well with a string, and hold the bladder in boiling water for some time. This being done it is taken out and let dry in the shade.

Yolk of egg possesses nearly the same properties as ox gall, but is much more costly. It must be used as quickly as possible, for it loses its efficacy with keeping. It is sometimes mixed with an equal bulk of oil of turpentine.—*Moniteur de la Teinture.*

Whooping Cough and Fungus.

Some years ago M. Svetzerich made the assertion that whooping cough was caused by a certain fungus. This assertion seems lately to have been confirmed by the researches of M. Yschamer, who says he has found certain lower organisms in the spittle of whooping cough patients—organisms not met with in any other disease accompanied by cough and expectoration. Examining the spittle after it has been a short time suspended in water, there are found corpuscles about the size of a pin's head, of white or slightly yellowish hue, and these show, besides apathetical cells, a network frame of polygonal meshes, with rounded greenish sporules; at a more advanced stage, colorless hyphæ are seen, and large sporules, yellowish or brownish red, sometimes even ramified. It is interesting to learn that the champignons in question are quite identical with those which, by their agglomeration, form the black points on the skins of oranges and the parings of certain fruits, especially apples. Thus, M. Yschamer, by inoculating rabbits with this dark matter, or even causing it to be inhaled by men, produced fits of coughing several days in duration, and presenting all the characters of the convulsive whooping cough.

The Geological Relations of the Atmosphere.

At one of the recent sessions of the French Academy of Sciences a communication, with the title which heads these notes, was read from Professor Henry Hunt. This paper, of which we make a brief abstract from the text contained in one of our French exchanges, puts forth a curious theory. Taking into account the enormous quantity of carbonic acid stored up in the vegetation forming the coal deposit, and the much greater quantity of the same gas which is met with in the calcareous formations, Professor Hunt believes that it must be admitted that this gas has an extra-terrestrial origin. He believes that our atmosphere should be considered as a universal cosmic medium, condensed around the centers of attraction by reason of its mass and temperature, and occupying all the interstellar spaces in a state of extreme rarefaction.

By considering the question from this standpoint he deduces the conclusion that the atmospheres of the different celestial bodies should be in equilibrium, and so much so that every change that supervenes, be it either by condensation of aqueous vapor or carbonic acid, or by the setting free of oxygen or any gas whatever, would make itself felt in all the rest of the planets through the effect of diffusion. So, then, during those periods in which a great absorption took place on the face of our globe, our atmosphere would have been constantly fed by new portions of gas coming from the universal medium, and consequently from the gases surrounding the other planets.

From this it is understood that the proportion of carbonic acid in the atmosphere of the other planets must have experienced an equal diminution, at the moment that the excess of oxygen spread over the surface of our globe was equally diffused through their atmospheres.

Professor Henry Hunt sees in this theory the explanation of the origin of the cosmic dust.

A Quicksilver Motor.

A street car motor to be run by quicksilver is being manufactured at Aurora, Ill. About 800 pounds of quicksilver is to be placed in a reservoir at the top of the car and to pour down over a cast iron over-shot wheel, producing an equivalent of three horse power. The quicksilver is to be returned to the reservoir by pumps placed underneath the car, to be operated by a brakeman by means of a crank on the fron-platform.—*St. Louis Miller.*

There must be some mistake here in the calculations. Allowing a distance of 10 feet from the quicksilver reservoir to the point where it strikes the wheel, then the utmost force yielded by the fall of the 800 pounds of liquid metal will be a little less than one quarter of one horse power. To pump up the liquid again would keep the brakeman constantly at work. He could propel the car faster and to better advantage by simply walking behind the vehicle and pushing it forward with his hands, thus dispensing with the weight, and cost of 800 pounds of quicksilver, reservoirs, pipes, wheels, etc. In order to realize three horse power from a wheel arranged as above, 10,000 pounds, or five tons, of quicksilver would be required; and to pump it back the labor of fifteen men would be necessary. We fear that the new motor is destined to stand still.

The Metric or Decimal System.

The following simple table gives all that there is in the metric or decimal system of weights and measures:

MONEY.

10 mills make a cent.
10 cents make a dime.
10 dimes make a dollar.
10 dollars make an eagle.

LENGTH.

10 milli-meters make a centimeter.
10 centi-meters make a decimeter.
10 deci-meters make a meter.
10 * meters make a decameter.
10 deca-meters make a hectometer.
10 hecto-meters make a kilometer.
10 kilo-meters make a myriameter.

WEIGHT.

10 milli-grammes make a centigramme.
10 centi-grammes make a decigramme.
10 deci-grammes make a gramme.
10 † grammes make a deccagramme.
10 deca-grammes make a hectogramme.
10 hecto-grammes make a kilogramme.
10 kilo-grammes make a myriagramme.

CAPACITY.

10 milli-liters make a centiliter.
10 centi-liters make a deciliter.
10 deci-liters make a liter.
10 ‡ liters make a decaliter.
10 deca-liters make a hectoliter.

The square and cubic measures are nothing more than the squares and cubes of the measures of length. (Thus, a square and a cubic millimeter are the square and the cube of which one side is a millimeter in length.) The are and stere are other names for the square dekameter and the cubic meter. —*Boston Transcript.*

* A meter is equal to 39·368 American inches.
† A gramme is equal to 15·433 grains troy or avoirdupois.
‡ A liter is equal to 2.113 American pints.

A WONDERFUL TREE.

The plant illustrated in the accompanying engraving is perhaps one of the most extraordinary vegetable productions, in many respects, on the face of the globe. Seldom, if ever, has the discovery of a new plant created such an amount of interest in the scientific world as did this. In the year 1860 an Austrian botanist, Dr. Frederic Welwitsch, while making explorations in Southwest Tropical Africa, under the auspices of the Portuguese Government, came upon an elevated sandy plateau about 500 miles south of Cape Negro. Here his attention was at once attracted to a number of curious objects rising from a foot to a foot and a half above the surface of the soil, varying from 2 to 14 feet in circumference, and having a flat, somewhat depressed top of a dingy brown color, and appearing more like large stools or small tables than any living plant. When his amazement at beholding such a scene was over, Dr. Welwitsch's first proceeding, of course, was to secure both a plant and sufficient and proper materials for determining its scientific classification. These materials were subsequently sent to Kew with the request of the discoverer that Dr. Hooker should examine and classify the plant; this the latter did, naming it *Welwitschia mirabilis*. The result of Dr. Hooker's labors was the subject of one of the most interesting papers ever read before the Linnæan Society.

As we have before stated, the Welwitschia rises no higher than a foot or so from the surface of the soil, and may, therefore, be called a dwarf tree. The roots branch just below the stock, penetrate several feet into the ground, and fix themselves so firmly in the hard, sandy parched soil that it was found extremely difficult to dig up a plant with the roots entire. The most peculiar part of this plant is the crown, into the edges of which (at the point of junction with the stock) the leaves are inserted. The outline of this crown is of an irregular oval or oblong form, and its surface (and indeed the whole exterior of the tree) is of a dirty brown color, hard, rugged, and cracked, and has been aptly likened by Dr. Hooker to the crust of an overbaked loaf of bread. It is seldom or never flat, but usually sunken or concave toward the center. From the edges, toward the center, the surface is covered with little pits, the marks or scars of fallen flower stalks. The leaves, like all other parts of the plants, are very extraordinary; each plant possesses two only, corresponding in width to the lobes of the crown, and running out right and left to the enormous length of six feet, and one twentieth of an inch in thickness. These leaves (which are not true leaves, but "seed leaves" or *cotyledons*) are normally entire, although they are seldom seen in that state, as they soon become split to the base into strips. They lie spread out flat on the ground, are of a leathery texture, and of a bright green color, with almost imperceptible parallel veins. They are described as being persistent during the whole life of the plant, which is said to be a hundred years or more.

This fact affords another instance of dissimilarity with other plants; for we know that the first or cotyledonary leaves of most plants drop off as soon as second leaves are produced. The Welwitschia is *dioecious*, that is, its male and female flowers are borne on separate plants. The inflorescence is supported on dichotomously branched cymes, which spring from the small pits or scars, before spoken of, upon the crown of the tree, close to the point of insertion of the leaves, and even occasionally below them. The fruit or cone (which is the only part of the plant bearing any general resemblance to the coniferæ, to which it is related) are, when fully grown, about two inches long, with four slightly convex sides, and of a bright red color. The seeds, which are contained one in each scale, are surrounded by a broad, light-colored, transparent wing. It is highly probable that the fertilization of the female flowers is effected by insects, as it appears "that a pollen-feeding group of coleoptera, the *Cetoniæ*, abound in the regions inhabited by the Welwitschia." Dr. Hooker, after a careful microscopical examination of this extraordinary plant, placed it in the natural order *Gnetaceæ*, and regards it as having a very close affinity with the genera Ephedra and Gnetum. Outside of the high scientific interest with which it is invested, this plant has no recognized use. Its leaves, being tough, leathery, and not softly fibrous, are not adapted for cordage, weaving, or any similar purposes. Its tough trunk is of such an uneven, fibrous grain that the saw seems rather to tear than cut it; and besides, it is so irregular in its growth as to unfit it for any economic use.

No wonder, then, that the plants have been allowed to grow for centuries unmolested by the natives, and, consequently, up to the time of its discovery hidden from the eye of civilized man.

THE WELWITSCHIA MIRABILIS.

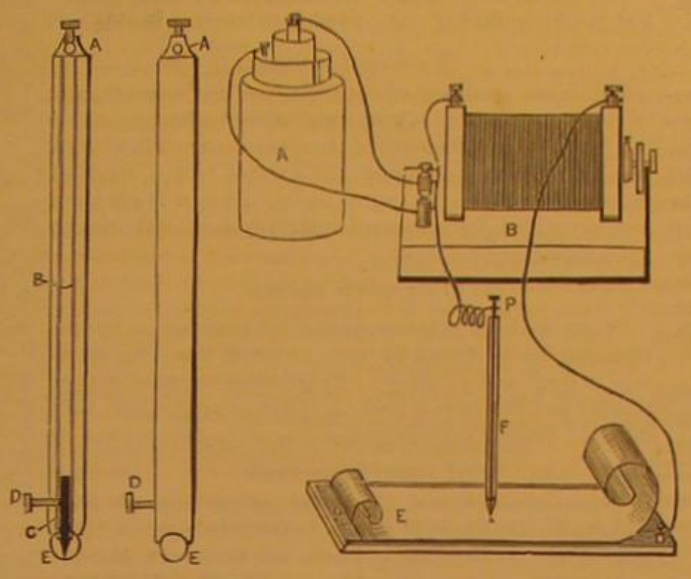
A SIMPLE ELECTRIC PEN.

We give below a description of a simple electric pen, which we extract from an article by Professor Wentworth Lascelles Scott in the *Electrician*.

The little contrivance which is shown in the accompanying engraving could be sold at a good profit for from 25*s*. to 30*s*. complete, or can be put together by any one possessing a very moderate amount of electro-mechanical skill at even less cost than the former sum, while the "pen" *per se* is as convenient and as light to hold as an ordinary pencil, and can be actuated by a comparatively very small single cell battery.

The accompanying rough sketch needs but little explanation, and shows fairly well the arrangement devised and actually used by me.

A is a Daniell's cell of medium size, which is all the battery power required; indeed, a very small bichromate or "Marié-Davy" couple may often be substituted here, where the pen is not required for very hard and continuous use. The battery is connected in the usual way to the primary terminals of a small induction coil, B, and for this purpose one of the little coils generally accompanying the cheap French sets of apparatus for "vacuum tube experiments," answers very well if certain *simple improvements* be applied thereto. As a rule these tiny "Ruhmkorffs" give a secondary spark of from one eighth to three sixteenths of an inch in length, but would give a much longer one only that the vibrating armature is not sufficiently delicate, while the condenser is often only a delusion and a snare. The former should be more delicately adjusted, a really elastic bit of spring being added if necessary, and the latter should be taken out and replaced by a sound and practical condenser, containing 300 or 350 square inches of tin foil, carefully insulated with paraffin paper. When these alterations are completed, it will be found that the spark is increased in length to some five sixteenths of an inch, or even more. The desk or writing slab consists of a plate of glass or vulcanite of suitable dimensions, upon which has been evenly laid a perfectly smooth, but rather smaller sheet of silver or tin foil, D, the whole being protected from damp by a coat of thin amber varnish; at one corner of the slab is *fixed* a binding screw, E, in contact with the metallic surface, and connected by a wire with one terminal of the secondary coil.



A SIMPLE ELECTRIC PEN.

The writing stylus or "pen," F, consists of an ivory or vulcanite tube, pointed at its lower extremity, and provided at the other end with a small brass terminal; from the latter a stiff wire, furnished with an extremely fine platinum point (*p*) proceeds in the interior of the tube, and is capable of adjustment by a small set screw. In practice this platinum point should be (when the stylus is turned up) very slightly below the level of the aperture in the ivory. The "pen" being then connected to the free terminal of the secondary, and the little coil set so that the primary sparks appear almost continuous by reason of their very rapid succession, a sheet of paper laid upon the slab, C, will be quickly perforated in a series of minute holes if the point of the stylus be gently drawn over it. Any writing, plan, or outline drawing, may be traced in this way upon the paper, although in a somewhat slower manner than with an ordinary pen. When removed from the slab the paper is found to be a kind of stencil plate, from which, by laying in succession upon a number of sheets of paper, and applying the ink roller or "dubber," many hundred *fac-simile* copies may easily and quickly be obtained.

If an "electro-stencil" of a large architectural or other plan or of a map be wanted, a slightly modified stylus will facilitate the work. Fig. 2 shows such an instrument drawn to scale (half the original size), Fig. 3 being a section of the same.

A represents the terminal for the reception of wire from coil. B is a brass tube extending to within an inch of the "writing," or lower end of the stylus, where it receives a pointed platinum wire, C, which can be fixed at any required height by means of the set screw, D. A small ivory wheel, E, enables the stylus to travel easily and evenly over any long continuous lines, either with or without the aid of a ruler.

[Other applications of this simple and easily constructed electric pen will suggest themselves to the intelligent reader, and it may readily be made (if really needed) far more rapid in its action than the costly instrument before alluded to. Its use infringes no patent, as its action depends upon well known principles, which have been applied somewhat in the same way for lecture demonstrations.

The circumstance that a whole generation of students and inventors have missed this simple and useful application of electricity, strikingly illustrates the blindness even of thoughtful men to practical opportunities which lie close at hand, but a little out of the common channels of thought. For many years it has been a well known fact that the spark of an intensity coil is capable of perforating paper; and now no one can see the practical application of that knowledge without wondering why he never thought of it. Who can tell what myriads of similar opportunities—what multitudes of good things"—are within the easy reach of whoever will get his mind out of the ruts of habit?

The world is full of possibilities for whoever can see them. The art of original personal seeing and thinking is what we all lack most.]

On Bronzes and Bronzing.

Bronzing, in the narrower sense, includes only those manipulations whereby the appearance of bronze is imparted to the surface of an article made of metal, wood, plaster, or other like mass, by covering it with a metal. The meaning of the word has been extended so as to include every process whereby a metallic appearance is imparted to any non-metallic object, or the bright surface of a metal is covered with a thin, dull coating of brown, reddish, or even black color, to protect it from change.

In the former kind of bronzing very finely divided or pulverized metal is dusted upon the object after it has been painted with oil varnish and almost dry; in the latter kind of bronzing several different methods are employed. In the following lines we propose to describe the various operations, etc.

1.—BRONZE COLORS.

For the first kind of bronzing different bronze colors, metallic or dust bronzes, are employed; these are finely pulverized metallic alloys, which are much used to cover wooden, plaster, and metallic articles on account of their beautiful color and metallic luster. They are mostly made from the scraps and waste of real or imitation gold or silver leaf and other alloys, beaten very thin, mixed with honey or gum solution, and rubbed upon marble slabs. On a large scale the metal foil, greased with olive oil, is rubbed through wire sieves by means of wire brushes, and pulverized in steel mortars, then polished with revolving brushes.

The commonest bronze colors are: real gold leaf, Dutch leaf, mosaic gold, real silver leaf, imitation silver leaf, mosaic silver, copper bronze, bronze-colored bronze or bronze powder, the greenish copper bronze, brownish gold bronze, gold-colored copper bronze, blue bronze, and some alloys of bronze metal.

A.—REAL GOLD BRONZE.

This is made from the scraps of the gold beaters, and called in German grätze, krätze, schäbe, or schawine (scrappings, shavings). They are mixed with honey or gum, and ground on a glass plate, or under the hardest granite, to a very delicate powder, washed frequently with water, and then dried.

The different shades or color of gold bronze are distinguished as red, reddish, deep and pale yellow, or greenish. These shades are due to the amount of gold, or the proportion of gold to that of silver and copper.

By boiling with solutions of different salts or acidified liquids still other shades of color can be imparted to the bronze; if boiled in water acidified with sulphuric, nitric, or hydrochloric acid a bright yellow is produced; if the solution contains sulphate or acetate of copper it will be reddish; other shades are obtained by boiling with a solution of table salt, green vitriol, tartaric acid, or saltpeter.

Gold bronze can also be made by dissolving gold in aqua regia, and precipitating as a metallic powder by means of a solution of sulphate of iron, and then boiled out in different ways. The sulphate of protoxide iron must be dissolved in boiling water, and then sulphuric acid dropped into it, and stirred until the flakes of basic sulphate of sesquioxide dissolve again.

Gold bronze is also made by dissolving gold in aqua regia, and evaporating the solution in a porcelain dish. When nearly dry some pure hydrochloric acid is added, and the operation is repeated to expel any free chlorine and make a pure chloride of gold. The dry salt is dissolved in distilled water (1 liter to a ducat) and (8° Baumé) solution of pentachloride of antimony stirred in as long as any precipitate is produced. This precipitate is the gold bronze, which finds, when dry, the most extensive use for painting upon porcelain and glass.

Metallic gold in powder can also be obtained from solution in aqua regia by putting in a bright strip of some electro-positive metal like iron or zinc. The color of the gold bronze depends upon the composition of the gold employed. Its luster is improved by rubbing the dry powder.

B.—IMITATION GOLD BRONZE.

This is made, like the real gold bronze, from the waste of beating of the so-called Dutch leaf, by triturating with a solution of gum, washing in water, and drying quickly, then rubbing again to increase the luster. The color depends upon the proportion of copper to zinc; if the former predominates it is redder; if the latter, yellower; so that the deepest red consists of pure copper, the bright yellow of 83 parts copper and 17 of zinc, the orange red of 99 parts of copper and 1 of zinc. The violet and green shades are obtained by heating with a greasy substance—oil, wax, or paraffine—which produces a sort of patina.

C.—MOSAIC GOLD.

This substance is a compound of 64·63 parts of tin and 35.37 of sulphur, is free from taste or odor, soluble only in hydrochloric acid, aqua regia, and boiling caustic potash. It serves exceedingly well for bronzing plaster casts, copper, and brass, by mixing with 6 parts bone ash and rubbing on wet, also for making gilt paper and for gilding pasteboard and wood, when it is painted on with albumen or varnish. Mosaic gold of golden yellow color and metallic luster is obtained by heating 6 parts sulphur and 16 of tin amalgam with 1 part of mercury and 4 parts sulphur. A beautiful mosaic gold is made from 8 parts stannic acid and 4 of sulphur. The most beautiful and purest mosaic gold, which most closely resembles real gold, is made by fusing 12 parts of pure tin, free from lead, with 6 parts of mercury to an amalgam. This is mixed with 7 parts flowers of sulphur and 6 parts sal ammoniac, and subjected for several hours to a gentle heat, either in a glass retort or an earthen crucible, at first below a red heat, afterward, when no more vapors escape, it can be raised to a dark red. On heating, the sal ammoniac first escapes, then vermilion and some chloride of tin sublime off, and the mosaic gold remains on the bottom. The upper strata consist of delicate transparent brilliant flakes of the most beautiful mosaic gold.

D.—REAL SILVER BRONZE.

This is made either by triturating the scraps of silver foil, or by precipitating the solution with a strip of bright copper.

E.—IMITATION SILVER BRONZE.

This is obtained by triturating the scraps of imitation silver leaf, washing, drying, and polishing to increase the luster.

F.—MOSAIC SILVER.

This is an amalgam of equal parts of tin, bismuth, and mercury; 50 grammes of good tin is fused in a crucible, and as soon as melted 50 grammes of bismuth are stirred in with an iron wire until it is all liquid; the crucible is then removed from the fire, stirred as long as liquid, and then 25 grammes mercury added, and all mixed uniformly until stiff enough to be ground upon a stone.

G.—COPPER BRONZE.

This is made by rubbing copper foil very fine, or by precipitating from solution by strips of bright iron, then washing, drying and grinding. By grinding together copper powder and fine mosaic gold, in different proportions, very different bronzes are obtained.

H.—BRONZE POWDER,

or bronze-colored bronze, also called antique bronze, is made from 16 parts copper and 1 of tin, beaten into leaves and then ground up. J. Brandeis, in Furth, has invented a hammer and grinding apparatus for this purpose. The alloy is first rolled into sheets, then hammered out so thin that 1 kilo covers 120 square meters. Bronze powder is also made by dissolving bronze fillings in nitric acid and putting a rod of metallic zinc in the solution.

I.—GREENISH COPPER BRONZE.

This is obtained when copper bronze is put in a flask and covered with strong wine vinegar, stirred occasionally, left standing in the air, dried, and intimately mixed.

If copper bronze, or a bronze made by mixing mosaic gold with copper powder, is mixed with one quarter, one third, or one half its weight of verdigris (acetate of copper) a bronze is produced which imitates in color the patina upon antique bronzes.

Artificial patina powder is produced by treating bronze castings with different salts. Vinegar, nitrate of copper, sal ammoniac, common oxalate of potash, and similar compounds are employed to produce artificial patina. These solutions are used to oxidize one part of the bronze powder superficially, which is then ground with clean metallic bronze powder, producing a greenish bronze powder, with which the appearance of antique patina can be produced upon plaster casts or wooden objects.

K.—BROWNISH GOLD BRONZE.

This is made from fine clean iron filings by moistening repeatedly with a little water and exposing them to the air, then boiling several times and drying in the sun or on a stove. It forms a deep rust-brown powder, which becomes more intensely red if some nitric acid were added in the last boiling. It is elutriated to separate any metallic particles, and dried. By mixing this powder with imitation gold bronze mosaic gold, copper bronze, and greenish bronze, separately or together, the most varied and different shades of bronze color can be obtained.

L.—GOLD-COLORED COPPER BRONZE.

A copper bronze with golden color is produced by boiling together an amalgam of 1 part zinc and 12 parts mercury, some hydrochloric acid, a filtered solution of purified tartar crystals, and copper bronze precipitated from the nitrate by means of iron. This copper bronze has a reddish golden color, if only boiled a short time, and a deep yellow or green bright yellow by longer boiling. Another golden copper bronze is obtained by boiling the copper bronze with a solution of 1 part gold in aqua regia, evaporated to dryness, dissolved in 8 parts water, the solution boiled, and one half part ignited magnesia added, then boiled until the yellow color disappears. The precipitate of oxide of gold and excess of magnesia is filtered out, placed in a flask, and a boiling solution of 8 parts cyanide of potassium in water poured upon it.

Aurate of soda can also be boiled with the copper powder. The gold salt, prepared as above described, is dissolved in 130 parts of water and 11 parts bicarbonate of soda added, and boiled; then the copper bronze powder is put in and boiled until the desired color is obtained. If any gold remains in solution it can be recovered in metallic state by addition of a solution of protosulphate of iron.

M.—BLUE BRONZE.

The blue bronzes are produced in the wet way by coloring white bronze with aniline blue. For a long time vain attempts were made to obtain permanent and beautiful blue shades by heating by means of so-called "Anlauf" colors, which are due to thin films of oxide, as in blue steel. A white bronze made of pure English tin is boiled for 5 hours in a solution of 20 grammes of alum in 4½ liters of water, then washed clean and put into a porcelain dish, and covered with a solution of 15 grammes aniline blue in 1½ liters alcohol, and stirred until dry. This manipulation must be repeated six or eight times until the desired blue color is obtained. When the bronze is dark enough it is washed in warm water, and before it is quite dry a large spoonful of petroleum is poured upon each kilo of bronze, intimately mixed, and the odor allowed to escape into the air for a few days.

To obtain the copper in the form of flakes, which is the best for making bronzes, the oxide is best reduced by means of the more volatile oils of petroleum, such as gasoline, rhigoline, or petroleum ether. The reduction by rhigoline vapors is accomplished in a combustion tube, in layers 1 to 1½ centimeter deep, at a high temperature. The oxide is easily and completely reduced and converted into a loose scaly metallic form, which must be allowed to cool in an atmosphere of petroleum vapor and pulverized in an agate mortar. The other methods of reduction leave the copper in the form of powder, which is less suitable for making bronzes.

N.—SUBSTITUTES FOR BRONZE COLORS.

Besides the mosaic gold, or tin bronze, already mentioned, the following are also used:

Tungsten Bronzes.—Of these there are two kinds, the so-called safron or gold bronze, which is a tungstate of soda and tungsten, forming beautiful gold yellow brilliant crystals; the other is called magenta bronze or violet bronze, and is a tungstate of tungsten and potash, violet crystals that glisten like copper in the sun. By igniting metatungstate of potash strongly, tungstic acid can be prepared of a beautiful dark blue steel color. Unfortunately the tungsten bronzes do not fill their purpose completely, for on pulverizing they take a cubical form instead of the scaly form, and cannot be evenly distributed over the article to be bronzed.

Chromium bronze, or violet chromium chloride, forms beautiful violet crystalline flakes that sparkle like mica, is easily applied, but, unfortunately, too expensive as yet for use.

We may also mention titanium bronze, crystallized iodide of lead, and organic bronzes, which latter are derivatives of hematoxyline, and which have been employed for more than ten years in making bronze paper. Recently others have been made from coal tar colors. The best of the crystalline coal tar colors is the acetate of rosaniline, which produces a beautiful effect by its fine gold-green color and metallic luster. Not less beautiful are murexin and the green hydrochinon.

The mica bronzes, also called "brocade" or crystal colors, are made of mica, which is pounded up, then ground, boiled in hydrochloric acid, washed with water, until free from acid, and separated according to the size by means of sieves. Prepared in this way, the flakes of mica have a beautiful vitreous luster and silvery appearance, possess a metallic appearance, are perfectly indifferent to sulphurous emanations, and resist all changes in the air. It is suited to most metallic, papier maché, wood, glass, and plaster articles, and toys, for flowers, paper hangings, sealing wax, etc., also for painters and cabinet makers, and especially for decorative painting.

Mica bronzes can be made of a great variety of colors, the most important of which are the following:

Pink, mica colored with a decoction of cochineal, and hence soluble in hot water, so that the color is not fast. It turns blue with ammonia or hydrochloric acid.

Carmoisin, prepared with bluish fuchsin, is soluble in hot water, turned yellow by hydrochloric acid, and the color is destroyed by ammonia.

Violet, made by Hofmann's violet, is very soluble in water, ammonia destroys the color, hydrochloric acid changes first to green then to yellow.

Bright blue, prepared with Prussian blue, or finely pulverized indigo, is not soluble in water even if acidified, unless oxalic acid is used, nor in alcohol.

Dark blue, produced with purified aniline blue or with Girard's violet, is but slightly soluble in water, turns blue in hydrochloric acid, and loses color in ammonia.

Viol-blue, colored with logwood, is slightly soluble in water, not at all in alcohol, completely soluble only in dilute hydrochloric acid, and then forms dirty violet flakes.

Light and dark green are colored with turmeric and aniline blue, are insoluble in water, but soluble in alcohol.

Golden is made with turmeric, is slightly soluble in water, more so in alcohol.

Silver is the pure mica, probably brightened by a decoction of bark, is more soluble in water than in alcohol; finally,

Black, probably a mixture of logwood pigment with litmus.

In using these mica bronzes the article must first receive a ground color, white lead for silver, ultramarine for blue, etc. For this purpose we may employ either oil paint or a glue sizing consisting of 4 parts glue and 1 part glycerine, rubbed together and applied with damar or light copal varnish. As soon as this size is dry it is coated with a paste of 4 parts starch and 1 part glycerin, and a sufficient quantity of brocade strewn over it, left half an hour to dry, and the excess of the powder dusted off. It can also be pressed on with a roller. If a ground of oil paint is used, the varnish is allowed to dry until it is no longer very sticky, when the powder is strewn on as in other cases. A beautiful appearance is produced by a final coating of thin alcoholic damar or copal varnish.

Steel bronze consists of micaceous iron (eisenglanz) in fine powder. It is not very durable.

TO INVENTORS.

An experience of more than thirty years, and the preparation of not less than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. In addition to our facilities for preparing drawings and specifications quickly, the applicant can rest assured that his case will be filed in the Patent Office without delay. Every application, in which the fees have been paid, is sent complete—including the model—to the Patent Office the same day the papers are signed at our office, or received by mail, so there is no delay in filing the case, a complaint we often hear from other sources. Another advantage to the inventor in securing his patent through the Scientific American Patent Agency, it insures a special notice of the invention in the SCIENTIFIC AMERICAN, which publication often opens negotiations for the sale of the patent or manufacture of the article. A synopsis of the patent laws in foreign countries may be found on another page, and persons contemplating the securing of patents abroad are invited to write to this office for prices, which have been reduced in accordance with the times, and our perfected facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN.

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Notes & Queries

(1) G. N. S. asks for the process of tinning malleable iron. The castings are small and easily handled. A. The articles are cleansed by pickling them for a few minutes in a bath composed of 6 lbs. of water and 8 lbs. of sulphuric acid, and scouring them with sand. They are then heated to the melting point of tin and sprinkled with rosin powder, or dipped in melted rosin, and then in molten tin covered with tallow, brushed with a piece of hemp, and rubbed dry with sawdust or bran. If small, they are simply placed, after heating, in a shallow vessel with some melted tin, and brushed about with a piece of hemp sprinkled with dry sal ammoniac.

(2) G. J. S. asks how aniline black may be dissolved without the use of acids or glycerin, and how the color may be made permanent. I wish to use it for ink. A. There is an aniline black in the market quite soluble in hot water; it is called soluble nigrosine.

(3) J. E. F. asks how to make a freely flowing black ink for sketching, etc. A. Triturate soluble nigrosine with a small quantity of boiling water, and strain the hot solution. When cold, the ink afforded is ready for use.

(4) G. McM. asks how to color billiard balls. A. Red.—Soak the pieces for a few minutes in weak nitric acid, and then in a strong decoction of cochineal in ammonia water. Black.—Use nitrate of silver dissolved in water, and expose the pieces to strong sunlight. Or steep for several days in a decoction of 2 lbs. logwood, 1 lb. galls, and then for a few hours in acetate of iron (iron liquor). Green.—Steep in a solution of verdigris, to which a little nitric acid has been added, or in a solution of distilled verdigris in acetic acid. Sal ammoniac is sometimes added to this solution. Do not use metallic vessels. Purple.—Steep in a weak aqueous solution of terchloride of gold, or boil for some time in a strong aqueous solution of logwood extract, and then add 4 ounces of alum to the gallon of solution, and continue boiling until the ivory is sufficiently colored. Yellow.—Steep for 24 hours in solution of lead acetate, and after drying in solution of potassium bichromate. Or steep the pieces in a saturated solution of orpiment (sulphide of arsenic) in strong ammonia, and dry. The depth of color depends upon the degree of concentration of the solution. Blue.—Stain them green and then immerse in hot solution of pearl ash. Or boil in logwood decoction and then in aqueous solution of copper sulphate. Or steep them in weak solution of sulphate of indigo, to which a little tartaric acid has been added. The coal tar colors, though brilliant, are apt to fade.

(5) C. E. N. asks how to make, and how to put on a good polish for black walnut tables used for hot and cold water in a bar room. A. Use a cloth cushion moistened with clear solution of 1 part shellac in about 10 parts of alcohol, applying a few drops of linseed oil to the cushion occasionally during the operation of polishing.

(6) E. D. S. asks: Is there anything that is applicable to window glass that will keep frost from accumulating on it, in cold weather? A. Glycerin is sometimes used.

(7) H. M. A. asks if freezing injures cider for drinking or for vinegar. A. No.

(8) C. L. H. asks: Can you kindly tell me in your paper some effective, cheap alarm for a bell telephone? I am unable to use an electro-magnetic bell for reasons. A. Such an alarm as you require is described in SCIENTIFIC AMERICAN SUPPLEMENT No. 161.

(9) H. M. N. asks: 1. What causes such a variety of colors to appear on oily water? A. It is due to the phenomenon called by physicists interference of light, caused by the varying thicknesses of the film of oil. A fine illustration of this may be observed in the soap bubble. 2. Why is tallow for steam engine cylinders preferable to any other lubricator? A. Pure tallow has less tendency to decomposition than oil under similar conditions. A pure hydrocarbon is, however, preferred by many, especially in high pressure engines.

(10) U.S.A. writes: 1. In your SUPPLEMENT No. 149, you describe how to make a simple electric light, and how to make the batteries. In battery, Fig. 4, should the small hole which is in the bottom of all flower pots be closed? A. Yes. 2. Should I put the same solution which is used in the pipe bowl, in Fig. 3, in the flower pot? A. Yes.

(11) Keho asks: Would a ten pound cannon ball sink to the bottom, if thrown in the deepest part of the ocean? A. Yes.

(12) L. E. L. asks (1) for an explanation of the principle of the gyroscope. A. See SCIENTIFIC AMERICAN, vol. 38, p. 335. 2. How can I make a cheap telephone? A. SCIENTIFIC AMERICAN SUPPLEMENT No. 142, contains full instructions for making telephones.

(13) C. M. D. asks how a Maynooth battery is made and charged. What liquid in the porous cup, and what in the iron one? A. It consists of a water tight cast iron cell, containing a porous cell, within which is a plate of zinc. The iron cell is charged with a mixture of equal parts of nitric and sulphuric acids, and the porous cell with sulphuric acid 2 parts, nitric acid 1 part, water 18 parts.

(14) M. asks: Is there any cure for a cracked plantation bell without recasting it? A. Drill a hole at the end of the crack, and saw through the crack to the hole. If the bell is too hard to admit of this treatment, we know of no cure.

(15) "Reader" writes: I have a hard rubber comb, it acts on paper and hair the same that a magnet does on a steel needle, why is it? A. Hard rubber, sulphur, wax, glass, and other substances, when rubbed with silk, flannel, or fur, become electrified and acquire the property of attracting light bodies.

(16) A. H. V. asks if Brazilian pebble spectacles are injurious to the eyes. A. They are generally considered better than glass.

(17) Otto writes: It is asserted that the whole mass of water in the Hudson (down to the very bottom) would flow north during the flood tide. Is it possible? A. We do not think the entire mass of water flows back with the tide. For a considerable distance this may be the case, but there is a neutral point beyond which the downward flow of the river is simply retarded.

(18) C. N. A. writes: I desire to construct an induction coil according to the method given in SUPPLEMENT No. 160, and would like to ask if it would not be possible to use coarser wire than No. 36 for secondary coil, without destroying the effect—say No. 30 or 32? A. No. 30 or 32 will not do as well as No. 36.

(19) L. H. asks: 1. In making India ink pictures with a brush how are the shades made smooth and merged evenly out into the white of the card board on which they are painted so that they will look like a photograph? A. The first requisite is the proper quality of paper. The tints should be carefully washed, one over the other, beginning with the lightest. 2. Is there a cheaper way than the electric pen to get several copies of written manuscript? A. Manifold paper is not expensive and answers a good purpose.

(20) A. H. writes: I have occasion to work in pearl, and I find a great deal of trouble in doing so, especially in turning it, it being so extremely hard. Will you give me some particulars in working it? A. There are two kinds of shells used in the manufacture of small articles; the porcelainous and the nacreous. The former are extremely hard, and can be worked only with the apparatus employed by the lapidary. The latter are more generally used, and may be sawn, filed, and turned, with some facility. The pieces should be roughed out on a common grindstone. After turning, they should be smoothed with pumice stone and water, and polished with rotten stone wet with sulphuric acid slightly diluted.

(21) G. J. B. asks: Is it possible for the ground under fifteen feet of water in the ocean to freeze? An old captain in this place says he has known it to be frozen off Fire Island in 15 feet of water. A. Not in water freely open to the sea. In confined coves it might possibly happen in the latitude of Fire Island, but even that is doubtful.

(22) G. W. M. writes: My friend holds that not one half of the leading astronomers believe the moon to be a lifeless planet without air or water, and I hold that fully four fifths of the astronomers believe it to be dead. Your opinion is desired. A. The moon is considered as lifeless by most astronomers.

(23) E. H. G. asks: Would a sheet of copper placed between two zinc plates, in place of the platinum sheet used in the "Kidder battery," produce a current of electricity? A. It would afford a fair current for a short time.

(24) P. F.: Kienmayer's amalgam for electrical machines is prepared as follows: one part of zinc and one part of tin are melted together and removed from the fire, and two parts of mercury stirred in. The mass is transferred to a wooden box containing some chalk, and then well shaken. The amalgam before it is quite cold is powdered in an iron mortar and preserved in a stoppered glass vessel. For use a little lard is spread over the cushion, and some of the powdered amalgam sprinkled over it and the surface smoothed by a ball of leather.

(25) W. C. M. asks for the names of the latest and best receipt books and chemistries on dyeing, as he is in the dyeing and scouring business for ladies' and gentlemen's goods. A. The SCIENTIFIC AMERICAN SUPPLEMENT contains the latest information on the subject of dyes. See Nos. 53, 55, 68, 74, 75, 76. Napier's "System of Chemistry applied to Dyeing." Gibson's "American Dyer." O'Neil's "Dictionary of Dyeing, etc." Smith's "Dyer's Instructor."

(26) J. L. asks: 1. Will the armatures of a number of telegraph instruments all make the same movement when the circuit is broken? A. Yes. 2. Would all move the same distance if the circuit should be closed before the armature of one had reached its full distance from the magnet? A. Yes, as we understand you. 3. Will the telephone work on a line in connection with a battery, or must the battery be cut out? A. A battery does not interfere with the working of the telephone when the circuit is continuous. 4. What is there to prevent the use of the telephone instead of the Morse telegraph? A. It has in many instances replaced the telegraph.

(27) C. W. asks: 1. What kind of carbon is used in the porous cup of a Leclanche battery, and is it powdered, granulated, or in lump? A. Use carbon from gas retorts. It should be coarsely powdered. 2. In what proportion is it mixed with the peroxide of manganese? A. We have see batteries filled with the carbon alone that seemed to work quite as well as those containing the peroxide of manganese. The proportions of the two should be about equal. 3. Should the porous cup be packed full or only partly full? A. The porous cup should be filled. 4. Will a pencil of zinc such as is generally used give as strong a current as a piece of zinc placed around the cup as in the carbon battery? A. Yes.

(28) W. S. R. asks: How can I polish a piece of marble? A. Smooth it with sand and water applied with a marble rubber, then rub it with pumice stone, and finally with a paste of putty powder, using a felt rubber.

(29) B. E. B. asks how the gilt work on gas fixtures is produced. A. In some cases it is simply brass, spun, burnished, or polished, and lacquered; in other cases it is produced by the application of bronze powders.

(30) J. McA. writes: Wishing to construct a dynamo-electric machine, after the plans given in SUPPLEMENT No. 161, I ask: 1. Does this machine, whether magnet is excited by battery or not, require an induction coil to be used, to produce an electric light? A. No induction coil is required. 2. Would common Western Union local battery answer instead of Bunsen cells; if so, how many? A. 16 or 12. 3. A light of what candle power will this machine produce? A. We do not know the photometric value of the light, but we think it would equal 4 or 6 gas jets. 4. Will increasing width, height, and wire on both magnet and armature increase the power of this machine in proportion? A. Yes.

(31) "Canuck" writes: I have made a pair of Bell telephones according to directions as given in *Popular Science Monthly*. Used a steel bar one quarter inch diameter and five inches long for core, and wound for one half inch on bar silk covered No. 60 copper wire until the diameter of bar and wire was about three quarters inch or seven eighths inch. Took the thinnest ferrotype plates for diaphragms and have used a Daniell battery varying in strength from one to twelve cells, still it fails to transmit sound. A. Use three eighths inch magnets, and No. 36 wire. No battery is required. See SCIENTIFIC AMERICAN SUPPLEMENT No. 142, for directions for making telephones.

(32) C. H. K. asks how many pounds pressure (steam) per square inch a boiler made of No. 14 standard gauge, charcoal iron, will stand with safety. Size of boiler 12 by 24 inches. Single riveted seams. A. Safe working pressure, 40 to 50 pounds.

(33) W. W. asks: What is the largest sized steam boiler that can be practically heated by crude petroleum? A. So far as we know, the limit is the same as obtained when coal is used as fuel.

(34) H. T. asks what is used to black the inner surface of tubes of fine optical instruments. It must be easily applied. A. Coat the surfaces with good gold size, and, while still adhesive, dust over it quickly lamp black, or, what is better, ivory black reduced by grinding to an impalpable powder.

(35) A. B. D. asks in which position can a bell be heard the farthest, on an open prairie, close to the ground, or on a tower two hundred feet high. A. On the tower.

(36) F. A. T. asks how to put a polish on fine walnut furniture. A. Mix with two parts of good alcoholic shellac varnish, 1 part of boiled linseed oil, shake well, and apply with a pad formed of woolen cloth. Rub the furniture briskly with a little of the mixture until the polish appears.

(37) T. J. B. asks: Should the slides of an engine be set a trifle lower at the end towards the crank to hold the weight (of piston) off the lower surface of the cylinder on a horizontal engine or not? A. They should be level.

(38) S. wants to know how much steam power would run a fan to furnish an ordinary blast for a cupola with a melting capacity of not more than 300 lbs. of iron. Fan the old style. A. It probably would not require more than half a horse power, at most.

(39) N. G. asks what photographers use to polish or glaze photographs. A. Heated burnishing rolls.

(40) G. E. asks how to melt old rubber belting and scraps of rubber, such as hose and door mats, over again and make it elastic so that it can be used in making the moulds for plaster casts. A. Old rubber cannot be melted as you suggest—it suffers partial decomposition in heating and does not again assume its original properties. Such moulds can be made from the gum rubber, as described on pp. 35 and 105, vol. 38, SCIENTIFIC AMERICAN, but they are too costly.

(41) H. N. D. asks how to make steel run sharp when poured in moulds. A. It is only necessary to use a suitable quality of steel to insure this result.

(42) G. D. H. asks for the method of manufacturing oakum. A. By picking old hempen rope into fibers.

(43) C. A. H. asks: Is there any work published giving a history of the success reached in attempts at utilizing anthracite coal dust or culm for the purposes of fuel, or which explains the peculiarities of coal dust and the impediments in the way of its utilization? A. There is some valuable information on this subject in Bourne's "Steam, Gas, and Air Engines."

(44) W. H. C. asks for a simple method of electroplating. What shall I use to remove the fatty particles entirely from the work? A. For silver plating the bath consists of potassium-silver cyanide, prepared by precipitating solution of silver nitrate with potassium cyanide, and redissolving the washed precipitate in excess of potassium cyanide solution—potassium cyanide, 12 oz.; water, 1 gallon; silver cyanide, about 1 troy oz. Filter and use in a porcelain or glazed vessel. For the whitening bath dissolve 1 lb. potassium cyanide in 1 gallon of water, add one quarter oz. troy of silver cyanide, and filter the solution. The baths are provided with silver feeding plates for anodes proportioned in size to the surface of the work to be plated. These are connected with the positive pole of the battery. The cleaned articles are connected by a copper wire with the zinc pole of the battery, dipped for a minute or two in the whitening bath, and when uniformly coated with a white film of silver transferred to the plating bath, under similar conditions. 3 or 4 Smee cells with plates 10x4 inches will generally suffice for the plating bath, and 4 or 5 similar cells for the whitening bath; 20 to 30 minutes in the plating bath is usually sufficient to plate the work properly. Articles of copper, brass, or German silver, to be plated should first be cleaned by boiling them for a few minutes in strong potash water to free them from traces of oil or grease, and, after rinsing, in dilute nitric acid to remove any oxide, and again thoroughly rinsed. It must not be touched by the hand after cleaning. Just before putting the work into the bath, dip it momentarily in strong nitric, or a mixture of equal parts nitric and sulphuric acids and rinse quickly. After this treatment it is sometimes dipped for a moment in dilute aqueous mercurous nitrate solution, and rinsed again. This has the effect of coating the clean metal with a film of mercury, which secures a perfect adhesion of the deposited silver. For nickel plating see article on p. 209, vol. 38.

(45) J. S. L. asks: Of what material are the printer's inking rollers made? A. Usually of glue and molasses, glue and glycerin, or glue, glycerin and oil. Those of glue and glycerin are prepared as follows: Glue is melted in water by the aid of a salt water bath into a very thick paste, to which undiluted glycerin is added in quantity by weight the same as that of the dry glue. The mixture is then thoroughly stirred and further heated to evaporate the excess of water. It is cast over a mandrel in iron or copper mould well oiled, and allowed to cool slowly and thoroughly before being removed.

(46) W. B. K. asks: Can you tell me about the sized boiler and fly wheel for a cylinder 1 inch bore and 2½ inches stroke? A. Boiler 15 inches diameter, 30 inches high. Fly wheel, 6 to 8 inches in diameter.

(47) M. J. W.—See Schuman's "Manual of Heating and Ventilation."

(48) J. E. P.—A gravity battery should be used on a closed circuit, and it must not be moved about.

(49) E. asks: How can I become a mechanical draughtsman? A. Study lessons in mechanical drawing contained in the SCIENTIFIC AMERICAN SUPPLEMENT.

(50) F. J. H. writes: I wish to cast a cannon having brass and copper. I would like to have a receipt for a good composition, for I wish the gun to look nice and be strong. A. For a large gun, copper, 90; tin, 10. For a small gun, copper, 93; tin, 7.

(51) A. G. R. asks: Is there any invention for conveniently unloading hay in barns by removing the whole load at once from the wagon to the mow? A. Yes, but there is room for improvement.

(52) J. J. J. asks: 1. Can you refer me to a good book on draughting? A. See Prof. MacCord's drawing lessons in SCIENTIFIC AMERICAN SUPPLEMENT. 2. Where can I get good draughting tools? A. Consult our advertising columns. 3. How can I make a cheap invisible ink? A. See SCIENTIFIC AMERICAN SUPPLEMENT No. 157.

(53) A. C. B. asks: What power is cheapest and most convenient for a small shop requiring 4 or 6 horse power? A. A portable or stationary steam engine.

(54) T. B. asks: What is allowed for shrinkage of iron in bridge building? A. An allowance of one-eighth inch in 1,500 feet for each change in temperature of 1° Fah. is ample.

(55) F. W. Peirce asks if there is not a point in the periphery of a wagon wheel that stops for an instant as it comes into contact with the ground. A. Yes.

(56) M. A. R.—For full description of induction coil, see SCIENTIFIC AMERICAN SUPPLEMENT No. 160.

(57) G. I. T. asks: Would you recommend the use of galvanized iron tea kettles? A. No.

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

Carl.—It is arsenopyrite or mispickel, containing a little cobalt and a trace of nickel. It contains about 45 per cent of arsenic.—F. M. M.—I_2 is an excellent quality of bituminous coal, suitable for gas making. C_2 calcite—lime carbonate. A_2 chlorite schist. B_2 contains sand, clay, mica, iron, oxide, and peaty matter. D_2, orthoclase. F_3, quartz. H_2, anhydrite.—J. S. G.—The mica (biotite) has little commercial value. Those varieties containing a high per cent of potash are sometimes utilized for fertilizing purposes. G. F M.—It is kaolin, containing about 10 per cent of quartz sand. If properly washed it may be utilized for the manufacture of pottery, porcelain goods, etc. Fine English kaolin brings in New York from $15 to $17 per ton (barreled). A. A. G.—It is ferropyrite or crystallized bisulphide of iron (iron 46·7, sulphur 53·3) associated with quartz. When free from arsenic it is sometimes used as a source of sulphur in the manufacture of sulphuric acid and of sulphurous acid for bleaching. The mineral is commonly called fool's gold. See p. 7, vol. 36. J. D S.—The large piece is fibrous talc. The smaller fragment is a clay containing undecomposed orthoclase.—C. L.—No. 1, trap rock. Nos. 2 and 3, gneiss and mica schist—the dark mica is biotite. No. 4, principally orthoclase.

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COMMUNICATIONS RECEIVED.

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

Heating and Pounding of Crank Pin Journals. By J. R.
On the Gyroscope. By N. D.
On Mine Water in Fish Streams. By C. Smith.
A Biography. By W. B. C.
On Middlings Purifier Controversy By R. J. A.
On Shorthand. By H. H.
On the Sun's Rays. By B. B.
On What Congress Ought to Do. By G. H. K.

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INDEX OF INVENTIONS

FOR WHICH

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

January 14, 1879,

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.

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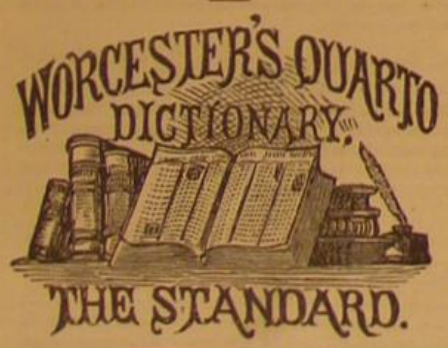

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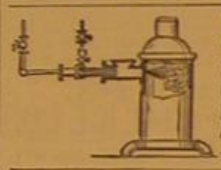

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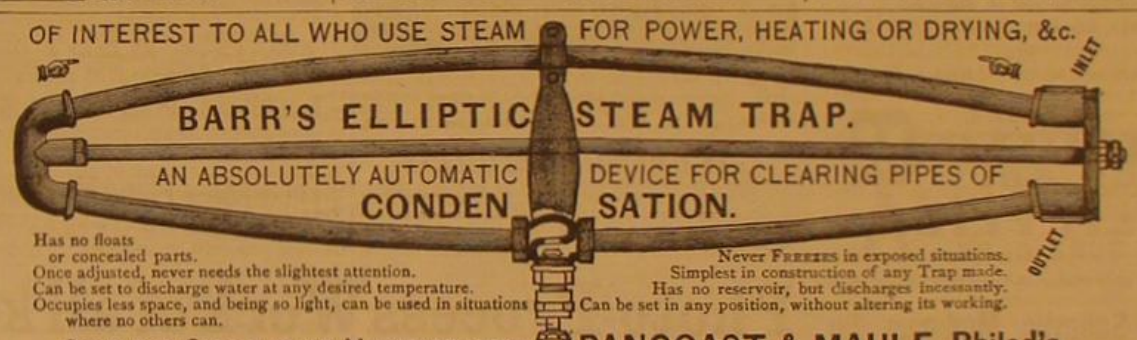

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