

SCIENTIFIC AMERICAN

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NOTES ON FAIENCE AND ITS MANUFACTURE.

No. III.

In our last issue we gave a brief history of faience ware. The present article treats on enameling and baking.

Faience must be baked twice: the body must first receive the necessary hardness, then, after the enamel has been applied to it, it must be baked again to vitrify the coating. These two operations may be carried on either together or separately in the same oven. An oven suitable for accomplishing either purpose alone is represented in Fig. 1. Fig. 5 shows an oven for carrying on both operations together. It is divided into two compartments, the upper one of which, being the hottest, is used for the first operation, while the enameling is done in the lower compartment. There are two fires, A and B, situated on opposite sides of the oven. Fig. 4 illustrates the position of the articles in the oven. They are placed on plates of unenameled faience or "biscuit," supported by pillars of the same material. The success of the operation depends greatly upon an exact regulation of heat. In this respect experience is the only guide. To observe the progress of the operation, cups formed of the same material, enameled and bare, are placed into a special compartment, easy of access, and heated to the same degree as the main portion of the oven. From their condition the progress of the operation may be observed. An oven large enough for about a gross of ordinary pottery consumes about seven cubic yards of wood during one operation, which lasts about 36 hours.

The enamel consists of: Minium (oxide of lead), 52 parts; oxide of manganese, 7; brick powder, 41; total, 100.

The substances are fused together and reduced to powder; the enamel is then ready for application. This enamel is intended for brown pottery. For white faience a mixture is used consisting of oxide of tin, oxide of lead, silice, sea salt, and carbonate of soda.

The oxides of lead and tin are intimately mixed and calcined; a yellow powder is thus obtained, called "calcine," and forming the base of white enamel. It is mixed with the other ingredients in the following proportions: Calcine, 47; sand, 47; sodium carbonate, 3; sea salt, 3; total, 100.

This mixture, melting at a temperature of 70° Wedgwood's pyrometer, is fused, and when cool it is finely pulverized. For application to the biscuit, it is triturated with water, which holds a considerable portion of the powder

in suspension. The articles to be enameled are simply dipped into this liquid, a sufficient quantity of the powder adhering to the surface. When the external surface is to be enameled brown the vessel is first dipped into the brown enamel; after drying, it is filled with white enamel, emptied, and allowed to dry again.

When dry all traces of enamel must be removed from the bottom of the vessel, as otherwise, in baking, the bottom would adhere to the support. The enamel is removed from the bottom by means of brushes; this operation is very injurious to health, as it fills the air with fine particles of lead

a beautiful luster. The coating is hard, and does not crack or scale off when it is of good quality and properly prepared.

When articles are to be decorated by painting, the paint is applied to the enamel when the latter has become cold. The goods are then again moderately heated, by which the colors are firmly attached to the enamel. The pigments used are essentially the same as those used in porcelain painting.

"Fine" faience, properly so-called, is a product of modern times, and must be distinguished from the "common" faience just described. It consists of an inner white, opaque

body covered by a crystalline lead glazing. The first "fine" faience was made in England, toward the end of the last century, by Wedgwood. It was he who discovered that silice is bleached by calcination, and that calcined silice bleaches clay. Pottery made from this material is very white and hard, ringing when struck with a hard body, with a clear metallic sound. Its beauty and durability soon brought it into great demand, and for practical purposes it is to-day universally used in preference to its rivals. It was also called half-porcelain, opaque porcelain, and china, although originally the latter term was used to designate regular porcelain, china, or fine faience. It cannot be cut by steel, and differs from porcelain proper only by its opaqueness, the latter being translucent and more completely vitrified. China industry is of the utmost importance in Europe, especially England.

As stated above, the material consists of levigated clay and calcined silice, to which sometimes a little chalk is added. The glazing is of variable composition, but consists generally of oxide of lead, or minium, silice, feldspar, and soda. It is prepared and applied like ordinary enamel.

In England three varieties of china are distinguished: 1. Pipe-clay ware, containing a little chalk. 2. Stone ware. 3. Feldspar ware.

English pipe-clay, according to Schuhmann, is composed as follows: Clay, 86 parts; silice, 13; chalk, 1; total, 100.

The glazing for pipe-clay ware consists of: Sand, 31 parts; minium, 30; litharge, 27; calcined feldspar, 7; borax, 3; crystal glass, 2; total, 100.

Stoneware, according to Oppermann and Battenaire, consists of: Clay, 87 parts; silice, 13; total, 100; and is glazed with the following mixture: Silice, 42 parts; minium, 26; borax, 21; sodium carbonate, 11; total 100.

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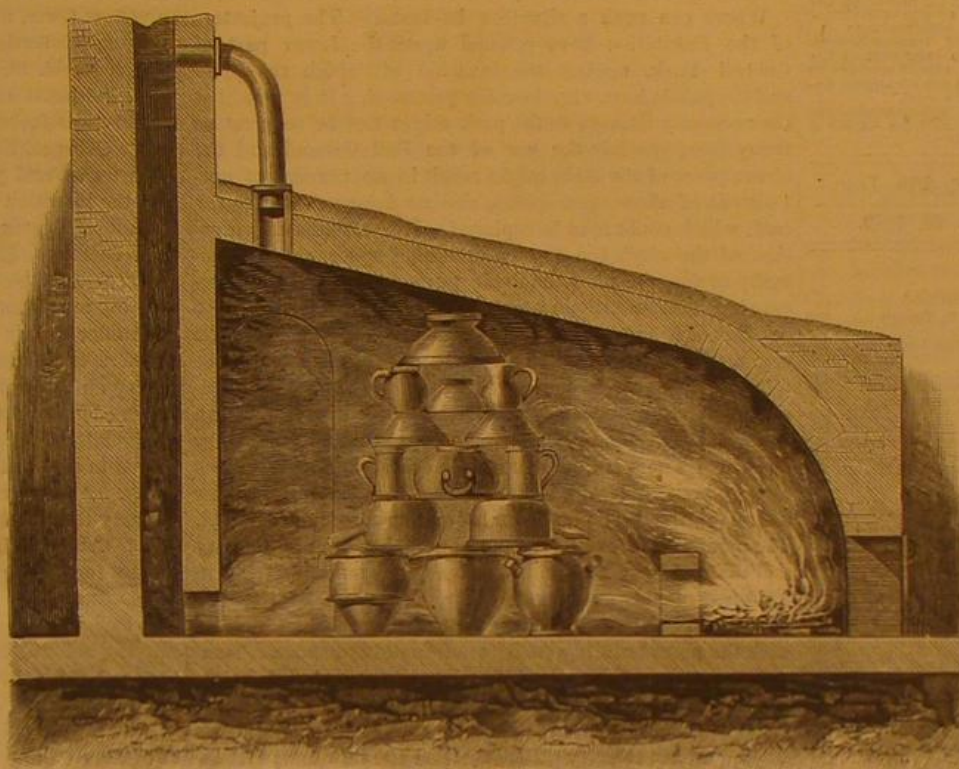


Fig. 1.—POTTER'S OVEN.

compounds, which are inhaled and swallowed by the operatives. This manipulation is called varnishing and brushing, and is illustrated in Fig. 2.

Fine faience goods must be placed in the oven very carefully. They are generally inclosed in muffles, made from biscuit, and these are placed on top of each other in the ovens; the latter holding about 20 to 30 of them, according to size.

Fig. 6 represents one of the chambers, containing several plates and a bowl in position.

By the application of heat the enamel is fused and partially penetrates into the biscuit, to which it imparts its color and



Fig. 2.—APPLYING ENAMEL.



Fig. 3.—PLATE MACHINES.

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THE SITE OF THE GREAT NEW YORK EXHIBITION.

The location of the buildings for the New York Exhibition of 1883 is just now the subject of much discussion. Though many conflicting interests are involved it is obvious that the question must be determined by a few paramount conditions.

Whatever local advantages may be offered by any or all of the suburban sites proposed, the single condition that the Exhibition must be easily and quickly accessible to the million people on New York Island, on foot as well as by horse or steam conveyance, should compel the selection of a site on the island and not above Central Park.

Accessibility by water from the surrounding cities, and convenience in handling materials as well as passengers, require that the site chosen should be near the water; the North River front offering by far the greater advantages.

As any money contributed by the city and State should be put into a permanent building (as was done at Philadelphia) the chosen location must comprise, in part at least, lands suitable for permanent occupancy by public buildings, and if possible already belonging to the city.

The temporary structures must be near the permanent buildings, and in a place suitable for the wholesome housing and accommodation of vast multitudes. In all probability the sites of such buildings must also be public land, since the enterprise could not afford to pay rent, and private citizens are not likely to contribute private property for such uses without remuneration.

Where can such a situation be found? The projectors of the Exhibition have pitched upon the lower part of Central Park, against the invasion of which the press and the public have very forcibly protested. It is true that the necessary damage to the park might not be so great as many fear; possibly the use of the Ball Ground and the Green (west of the Mall) might result in no permanent curtailment of those open spaces, and no injury except to the turf, which could soon be replaced. Nevertheless any invasion of the city's too limited breathing space, even temporarily or for the most laudable purpose, should be deprecated. From an artistic point of view the park would make an admirable setting for the Exhibition buildings; but the cost would, at the least, be altogether too great.

The city has already set apart for a museum and zoological garden the sixteen-acre area bounded by 8th and 9th avenues and 78th and 81st streets; and known as Manhattan Square. The plan of a magnificent structure there has already been perfected, and one wing built, making, so far as it goes, the best planned museum building in the world. The money contributed for a permanent building by the city and State of New York could be used in completing the central cross of this museum building. The rest of the plan might be developed as one story temporary buildings, giving, with the main building, 16 acres of exhibition space. Temporary structures covering 40 or 50 acres more will be required for the purposes of the Exhibition.

Instead of going into the park for sites for these buildings why could not the city utilize therefor the now unused roadways between Manhattan Square and the river, comprising four broad avenues intersected by cross streets at right angles, all as yet unoccupied, and all graded, paved, lighted, and drained by the city at enormous cost? A more convenient and wholesome situation for a great fair could not be found. The river front would accommodate all the shipping of the Atlantic coast. The Hudson River Railway and the two elevated roads traverse the region already, and could easily be made to furnish quick and comfortable conveyance for 300,000 visitors a day, in addition to the almost limitless facilities afforded by the river.

The crossing of 9th avenue by the Boulevard at 64th street would furnish an ample site for a vast building in the form of a St. Andrew's cross; the junction of the Boulevard with 10th avenue another site, equally good. Between 78th and 86th streets the Boulevard runs midway between 10th and 11th avenues. The three avenues with the cross streets would, anywhere in this neighborhood, furnish sites for Exhibition buildings surpassing in magnitude any ever dreamed of hitherto.

The diversion of the pleasure driving on the Boulevard to 9th or 11th avenue for a mile or so—the only inconvenience likely to accrue from the temporary occupation of the streets named by Exhibition buildings—would be as nothing compared with the evils and inconveniences sure to attend an invasion of Central Park. And the absence of immediate park surroundings to the buildings would be no serious objection to the proposed site for the fair, since it would be but a step from Manhattan Square into the park opposite the Lake and the Ramble.

The streets proposed to be occupied are of ample width for Exhibition buildings; the Boulevard is 150 feet wide, the avenues 100 feet, and the cross streets from 60 to 100 feet.

FROST AND YELLOW FEVER.

On the theory that yellow fever is propagated by germs which cannot withstand a freezing temperature, the United States Senate has passed a bill appropriating \$200,000 for the construction of a steel refrigerating ship to disinfect the holds and cargoes of vessels coming from infected ports.

The projectors of this plan of disinfection claim that no mere experiment is contemplated. The project, they say, is sure to succeed, since artificial refrigeration is a simple and well established process, and it is certain that yellow fever germs cannot withstand frost; accordingly it is perfectly feasible to freeze out any possible yellow fever infection that vessels from the tropics may bring to our shores.

Unfortunately, however, these confident statements involve several hypotheses which sadly lack confirmation. The germs themselves are hypothetical. We have no positive proof of their existence as living organisms; still less proof that frost kills them. It is true that an undetermined something, under favorable conditions not wholly understood, suffices to propagate the disease. It is true also that yellow fever epidemics in this country are stopped by cold weather. Yet, while the fever is not apt to rage in any locality during two successive seasons, except in the tropics, the proof that frost is the arresting agent, and that it is able to put an end to the disease permanently (or until it is reimported) is very far from satisfactory. It is no uncommon thing for refugees from fever districts to return to their homes weeks after frost has set in, and then sicken and die of yellow fever. It is even asserted, on fair authority, that cases of sickness, which no one would hesitate to pronounce yellow fever during the summer season, have occurred repeatedly during the past winter in towns along the lower Mississippi; yet there has been no lack of severe frost in that region.

The recent outbreak of yellow fever on the United States Steamer Plymouth, after spending the winter at Boston, and being subjected to freezing and fumigation, complicates the matter still more. The Plymouth came to Boston last fall, from a cruise among the West Indies, with yellow fever on board. The vessel was free from the disease during the winter; and if there is any truth in the theory that frost is fatal to yellow fever, no cases should have occurred on that vessel without reinfection. Yet as soon as the steamer, which left Boston March 15, had arrived in southern waters (about 300 miles southeast of the Bermudas) fever broke out and the steamer was forced to return. But one stop had been made at St. Georges, Bermuda, where there has been no yellow fever for several years.

If the infection of yellow fever can withstand the winter climate of Boston, why should it not that of Memphis or New Orleans? If it can, the importation of the disease is not necessary to start an epidemic next summer, in which case the most thorough refrigeration of incoming vessels will not suffice to stay the plague.

There is another objection to the spending of so much money on an experimental vessel. If refrigeration should prove adequate for the disinfection of yellow fever ships, one refrigerating vessel will scarcely begin to do the work required in all our southern ports; twenty would be none too many. And why should a special steel ship be constructed to carry the simple apparatus needed for the production of cold? Any existing river steamer or fair sized tugboat would suffice for that purpose; and the \$200,000 appropriated would fit up and charter a large number of such small vessels, each provided with all the machinery needed to refrigerate the hold of any vessel, should the experiment sustain the projector's theory. While two hundred thousand, or two hundred million, dollars would not be too much to pay for preventing an epidemic of yellow fever next summer, it is altogether too much to pay for an experiment which could be made for a tenth of the money, especially when there is a possibility that the wasted funds may be sorely needed in the practical application of the methods, the efficiency of which the experiment is expected to confirm.

THE AUSTRALIAN EXHIBITIONS.

The occurrence of two great Exhibitions in Australia, within a year of each other, is in some respects unfortunate; yet it may prove an advantage to exhibitors from this country and Europe, since it will be comparatively easy to transfer exhibits from the one to the other, and thus save the double ocean transit that would be required were the two Exhibitions more widely separated in time. Had Victoria and New South Wales united in a common exhibition, the display might have been grander, though it may well be doubted whether the commercial effect would have been so valuable. It must be remembered that Sydney and Melbourne are capitals of states together as large as France and Germany, and soon to be as populous; and in the absence of means of communication but few in either colony would be reached by an exposition at the capital of the other.

Though the smaller city, Sydney, has boldly taken the lead in inviting the world to compete for her trade, and will open the first world's fair south of the equator in September next, Melbourne follows in October, 1880. Like every other public work in New South Wales, the Sydney Exhibition is a government undertaking, and a large sum of money has been voted for carrying it out. The building is well advanced, and France and England have asked for more space than can be allowed. For American exhibitors there has been reserved 30,000 square feet on the floor of the main building, and half as much more for machinery. Already a considerable quantity of exhibits has been shipped from this port, and there is reason to hope that the United States will be creditably represented. It is proper to add that, with the exception of freightage, exhibitors will have no charges or commissions of any sort to pay. The space provided is free.

The foundation of the Melbourne Exhibition was laid February 19. The building is to stand in the center of a large public park—Carlton Gardens—on the highest land in the city, and is to cover seven acres; the whole Exhibition will occupy about twenty acres. The cost of the buildings and all expenses incidental to the Exhibition will be defrayed out of funds voted by the Victoria Parliament. Applications for space should be made not later than June 30 next. There will be no charge for exhibition space. American manufac-

urers will not need to be urged to secure for themselves a favorable representation in these exhibitions. The Australian market is an inviting one, and American goods have been received there with signal favor.

THE BICYCLE AS A PRACTICAL ROAD VEHICLE.

Now that the interest in this means of locomotion is increasing in this country, the question, Is the bicycle a practical road machine? is often asked, especially by those whose experience with the velocipede of 1869 fully demonstrated the impracticability of that article for such a purpose. In relation to the subject, a correspondent sends us the following:

On January 7 last, the writer purchased a bicycle with 52 inch driving wheel; weight of machine, 44 lb. Since that date, for a period of eleven weeks, I have ridden it 350 miles over the common roads of this section (Essex county, N. J.), riding 26 days, and ranging from 20 minutes to 3 hours' riding time per day. The speed has varied from 6 to 17 miles per hour, and I have ridden without difficulty through slush, mud, and snow, and over ice, frozen ruts, and cobble stone pavement. All ordinary hills have been ascended with comparative ease; extraordinary ones, peculiar to mountainous regions, it has not been my fortune to essay. The fatigue occasioned by a long or swift run is surprisingly slight and transient. No stiffness or soreness follows the effort.

A few days ago your correspondent took a 16 mile run over roads and under circumstances which afforded a good test as to the utility of the machine. Starting at 5 P.M., a stiff hill was ridden down at a walking pace by "back-pedaling," a curve at its base rendering it unwise to fly it. Three miles of lumpy, macadam road, very much out of repair, was succeeded by a better one, connecting with a common dirt road, which was slowly recovering from the effects of the winter season. This extended nearly two miles, and was ridden over slowly, but without trouble. Turning to the left, up the knobby Montclair turnpike, I found the wind strong against me, so getting well over the handles, I climbed slowly for two miles to Montclair. Here I turned and ran down, making the two miles in 7 minutes. The final run home of six miles, including the muddy dirt road, occupied 30 minutes. No fatigue was felt after this run—the exercise manifested itself only in an amazing appetite.

IS THE MOON INHABITED?

The question as to whether the moon is inhabited by organic beings—if not like those that live on our own globe, at least of a kind specially adapted by their structure and nature for existing under the very different physical conditions that obtain on our satellite—is one that has attracted attention for ages, and one, too, that has been argued *pro* and *con* with great ability by many learned and eminent men. The opinion of nearly all scientists of the present day, however, is that the moon is a "dead planet;" and that, inasmuch as she has but a slight and very rare atmosphere, and that, as a consequence, no water exists on her surface, she is entirely unfitted to be the dwelling place of any organic beings whatever—at least of any kinds that our minds can form any conception of. On the other hand, those who take the opposite view argue (to use the words of Dick) that "matter appears to have been created chiefly in subserviency to mind; and it is highly improbable that the Creator would leave a globe containing a surface of 15,000,000 square miles altogether destitute of sensitive and intellectual beings, especially when we behold its surface diversified and adorned with such a vast assemblage of picturesque and sublime scenery, and when we consider that every department connected with our globe is peopled with sentient beings of every description. Although seas and rivers and a dense atmosphere are not to be found connected with the lunar orb, and although some of its arrangements are different from those of the earth, yet these circumstances form no valid objection to the moon being inhabited, for the Creator can in all cases adapt the inhabitant to the nature of the habitation provided for him, as he has adapted the birds for winging their flight through the air, the fishes for gliding in the water, and man and quadrupeds for traveling the dry land."

Among the noted scientists of the present day who hold this opinion, but who found it on the latest discoveries of science rather than on the wisdom of the Creator, is the celebrated French astronomer, M. Camille Flammarion, who is at present organizing a subscription for the purpose of founding at Paris a free observatory created by private means. M. Flammarion not only believes that the moon is inhabited, but he believes that it will be possible to construct a telescope of such power as to bring the lunar orb so near our eyes that the question may be practically settled. In connection with this project he has recently written a long and interesting article entitled "Is the Moon Inhabited?" in which he ably reviews all the facts bearing on the subject. This article, which we have translated from one of our French exchanges, will be found in SCIENTIFIC AMERICAN SUPPLEMENT No. 170.

INTEREST-BEARING NOTES.

By the failure of so many savings banks and trust companies throughout the country a great many persons have not only suffered severe losses, but a large number have been greatly distressed by the loss of all their accumulations, at a time, too, when they most needed them. Not only those who were unfortunate in having their money in these weak institutions have been sorely troubled, but depositors in solid companies naturally become apprehensive for the safety of their savings and withdraw their deposits.

While we do not recommend persons of small means to keep their money about their person or hid in a stocking under the bed to tempt thieves, there are a great many who do this, for the reason they have lost confidence in all savings institutions. To this latter class of persons the new ten dollar interest-bearing certificates, now being issued by the United States Treasury, will be found equally safe and convenient as gold or greenbacks for circulation, and interest on their investment will be constantly accruing, therefore they are better to hoard than either silver or gold.

These notes are convertible with accrued interest at 4 per cent per annum into 4 per cent bonds of the United States, issued under acts of July 14, 1870, and January 20, 1871, upon presentation at the office of the Treasurer, Washington, D. C., in sums of \$50 or multiples thereof.

The certificates are a little shorter and somewhat wider than legal tender notes, which they otherwise resemble. A vignette of Benjamin Franklin is in one corner of the face side, with the figures and word ten in the other corner. They are dated April 1, 1879, and certify that the sum of \$10 has been deposited with the Treasurer of the United States under act of February 26, 1879; this certification bears the signatures of the Treasurer and the Register, and the Treasury seal.

On the back of the certificate are the words "ten dollars," and the following: "Interest on this note will accrue as follows: For each 9 days, or 1-10 of a quarter, 1 cent; for each quarter year, 10 cents; for each entire year, 40 cents."

THE ANILINE COLORS.

Take a little of any of the brighter aniline colors on the point of a knife and sprinkle it on the surface of still clear water in a transparent vessel. Immediately lines of color will curve downward through the water, intersecting and blending till the whole vessel assumes the brilliant tint. Occasionally a little mass, more abrupt in its movements than the rest, will strike directly downward, but before it goes far it will divide and sub-divide and form an inverted tree of color in the liquid. Having reached the bottom it will sometimes start upward, as though it had accomplished its mission and had no time to spare on its return. Often a mass of colored liquid will take the form of the smoke rings of a locomotive, and sometimes two of these rings will chase each other downward, the one in advance opening and allowing the other to pass through, which in turn waits for its comrade, and so on till they are destroyed by frequent collisions. Some of the colors are very different when seen by reflected and transmitted light, and the blending of the two when the vessel is placed in different positions with regard to the sunlight is very beautiful.

What are these aniline colors, and whence are they procured?

It is surprising what a mine of wealth has been found in the refuse matter of our gas works. The bituminous coal, which is there heated in great retorts, yields much that can be utilized besides the gas upon which our cities are so dependent. Upon the retorts, as a crust, gas carbon is formed; this is a good conductor of heat and electricity, and supplies the carbon cylinders or plates used in several galvanic batteries, and also the poles for the electric light. Most of the devices for electric lighting require this product of the old system for their successful operation. The interesting scientific toy, the microphone, which renders audible the tramp of a fly, the rustling of the softest brush, the noises of insects far too faint to be distinguished by the unaided ear, uses the conducting power of gas carbon as a necessary agency. Certain vapors pass from the retorts and condense in the colder tubes. From some of these almost all the ammonia salts, so indispensable to the chemist and various manufacturers, are procured. The nitrogen of the vegetables of the old carboniferous age, now for the first time released from its long imprisonment in the coal, comes to us in the form of these ammoniacal liquors. Another liquid thus condensed is coal tar, while in the retort, after the volatile ingredients have been expelled, remains a hard material resembling anthracite coal, and which is useful for the same purposes as that article—coke.

We will take the coal tar and trace out some of the products which may be derived from it. No less than forty different materials have been extracted from this unpromising-looking article by the art and skill of chemists. When subjected to distillation it is separated into various substances, which are more or less volatile. By raising its temperature gradually, and collecting in different receivers the compounds that pass off, these may be obtained distinct from each other in tolerable purity. At about the temperature of boiling water, benzol, or benzene, distills. The use of this for dissolving grease is well known. As the temperature is raised there pass off in succession toluol, phenol, naphthalene, anthracene, increasing in weight and solidity, the last being a heavy greenish oil. In the retort is left pitch, which is extensively used in the construction of pavements. The benzol, when subjected to the action of strong nitric acid, forms nitrobenzol, the artificial oil of bitter almonds, which under the name of myrbane is an article of perfumery. By the action of hydrogen this nitrobenzol is converted into aniline. The second product of the distillation of coal tar, toluol, may be passed through a similar operation, the resulting product being toluidine.

We have now arrived at the basis of our aniline colors. From the thick black grimy coal tar are produced the brightest and most beautiful colors which art can show. The most gorgeous dyes, rivaling in beauty the tints of the rainbow or of the sunset clouds, are the coal tar colors. Surely, never

was a stranger transformation; no substance could be found which at first sight would be accounted more utterly devoid of beauty than gas tar, and no stronger contrast could be seen than a bottle of it side by side with a transparent brilliant solution of aniline red, green, or violet. Many inks, both black and colored, are nothing but some of the products of aniline or its allied substances, dissolved in alcohol or water, and the brightly dyed ribbons of our streets are made beautiful, but often not permanently so, by the action of these marvelous coal tar colors.

It would not be interesting, except to a scientific man, to go over the various chemical changes by which aniline and toluidine are converted into the various colors. A combination of the two gives rosaniline, which is a kind of starting point in the manufacture. From this base, by the action of various acids, many of the colors are derived, while some are obtained from phenol and the other original products of coal tar distillation, though all are popularly but incorrectly known as aniline colors.

In the laboratory of the chemist the methods have been evolved and the products first obtained. Kept for a long time as a mere curiosity, their value as dyes was finally made known, practical men secured the secret of their manufacture, and vast industries, principally abroad, aggregating millions of dollars of capital, have sprung up. It is one of the many cases where the man of science, not for any mercenary purpose, but impelled by the love of investigation and discovery, has been a great material benefactor. Without his researches the grimy coal tar would have been grimy coal tar still, useful to paint fences, to preserve wood, and a few other minor purposes, but not suspected to be so rich a mine of wealth and beauty. One of the most brilliant discoveries of science in this line has been the artificial production of the coloring matter of madder. The dyeing quality of madder has been known for at least 2,000 years, and raising the plant and preparing the roots have been important industries in Zealand and many tropical countries. But recently two German chemists, working upon the known analysis of alizarine, a coloring principle of madder, have built up the substance itself, using as a base anthracene, one of the results of the distillation of coal tar. The artificial alizarine differs in no respect, chemical or physical, from the natural, possesses the same coloring properties, and its use has to some extent diminished the demand for the cultivation of madder. By what chemical process the plant, in nature's laboratory, forms its coloring principle we do not know; but we can trace every step of its formation from coal tar, and alizarine must henceforth stand side by side with safranin and the other so-called aniline colors.

It was about 50 years ago that Unterdoeben separated from indigo a substance which he called crystalline, which afterward became known as aniline, from the Portuguese *anil*—indigo. Until within 20 years it was deemed an unimportant substance, indigo being itself too costly to support any extensive manufacture; but since it has also been found in coal tar a continued succession of coloring products has been drawn from this apparently inexhaustible source; one of the latest of these has been uranine, a beautiful green fluorescent dye.

The aniline colors are not permanent. We have heard of the labels of boxes which were marked with aniline inks becoming entirely white, no vestige of a letter remaining, upon exposure to the sunshine in the transit, to the manifest inconvenience of the expressman. The writer having occasion to use some charts, made them partly with ordinary black ink and partly with crimson. In course of time the crimson faded away, leaving the black characters rather meaningless by themselves; and this in a position where no direct sun rays ever reached.

Some of them are, however, much more permanent than others, and for purposes which do not involve great exposure or rough usage they answer very well, while their brightness gives the dyer a power he cannot possess with the fast colors. Magenta, mauve, solferino, roseine, Tyrian purple, picric acid, and many others, enable him to add immensely not only to the brilliancy but to the variety of his shades.

The extensive employment of these colors in many articles of ordinary use has led to numerous experiments on their physiological effects on the human system. Pure aniline is a strong poison in the stomach, and both aniline and nitrobenzol, when taken into the lungs in a state of vapor, are very injurious. Numerous instances of serious impairment of the health of workmen employed in aniline factories are on record. In one case a workman broke a carboy of the liquid, and in wiping it up respired a large amount of the vapor; in a few hours his face and body assumed a leaden hue; his gums, eyes, and lips a bluish appearance from the formation of coloring matters in the blood, and the whole system was seriously deranged. Energetic treatment, however, saved his life. But the aniline colors, which are not pure aniline, are much less injurious. They adhere so closely to the dyed fabrics that there is no danger of their floating as dust in the air, as in the case of arsenical dyes, and when pure are but slightly poisonous even when taken internally, though hurtful substances, like arsenic, lead, and mercury, are used in the manufacture, and may exist in a greater or less degree in the colors themselves.

An ingenious apparatus, intended to reproduce telegraphically at a distance the pictures obtained in a camera obscura, has, says *Galvani*, recently been invented by M. Senlecq, of Ardres. The principle on which it is based is the property possessed by selenium of presenting a very variable and very sensitive electrical resistance according to the different gradations of light.

[Continued from first page.]

Feldspar ware, according to St. Amand, consists of: Clay, 62 parts; kaolin, 15; siliceous, 10; feldspar (decayed), 4; and covered with the following glazing: Oxide of lead, 52 parts; kaolin, 25; siliceous, 13; crystal glass, 10; total, 100.

The machines used for shaping fine faience are identical with those used for ordinary faience. For some articles which are manufactured in very large quantities, as plates, special machines have been devised.

Fig. 3 represents a plate machine. The shaft of the wheel carries at the top a circular block of wood, forming the counterpart of the inside of a plate. A sufficient quantity of clay, rolled so as to form a sheet of the required thickness, is placed upon this block and pressed down closely. To a standard is attached the shaping tool or "caliber," movable in vertical direction. Its profile at the lower edge corresponds exactly to the external form of the plate. By causing the wheel to revolve slowly, the plate is brought into the desired shape.

For forming articles not of circular shape or otherwise difficult to form, moulds of plaster of Paris are used. These, when dry, rapidly absorb the water from the clay and cause it to harden rapidly.

To bake the biscuit, the temperature must be brought up to about 100° Wedgwood's pyrometer; for enameling, 10° to 30° are sufficient.

Although not strictly belonging to the faïences, we may nevertheless mention in connection with it the so-called "gray pottery" (*grès-cérames*). It consists of dense, heavy material, which rings with a metallic sound. It is opaque, of a finely grained texture, and sometimes nude, sometimes glazed with a mixture of salt, oxide of lead, and silica.

Ordinarily it receives a sort of vitreous covering all over the surface, consisting of silicate of sodium and alumina, during the first baking, and a repetition of this latter operation is thus rendered unnecessary. The purpose is accomplished by simply mixing sea salt with the fuel used for baking. The salt evaporates, and the vapor, coming in contact with the heated articles, decomposes; the sodium oxide and the various other oxides generally contained in sea salt unite with the

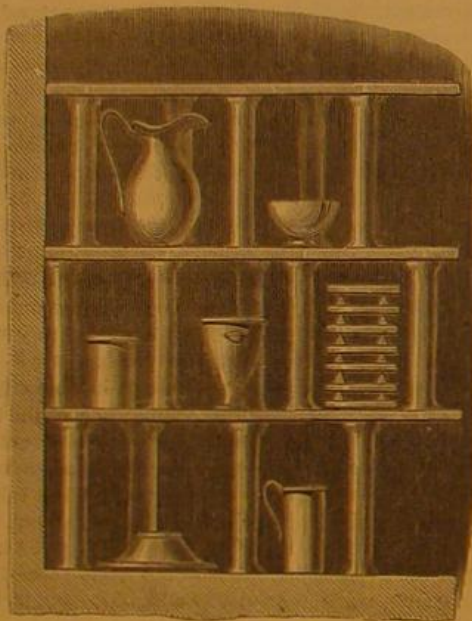


Fig. 4.—POSITION OF ARTICLES IN OVEN.

silica of the vessels and form a glass, which penetrates into the pores of the clay and renders it impermeable and glossy. This simple process is the invention of Wedgwood. 100° to 120° of heat (Wedgwood) are required to finish it. Fig. 7 represents an oven used for baking gray pottery. The articles to be baked are placed on Wedgwood shelves.

Gray pottery is very hard and brittle. It cracks frequently on sudden changes of temperature and when directly exposed to the fire. This quality of ware may be white or colored. The following is the composition of the material used in its manufacture:

White.—Kaolin, 25 parts; clay, containing a little kaolin, 25; feldspar, 50; total, 100.

Colored.—Kaolin, 14 parts; clay, 14; siliceous, 15; pegmatite (decayed), 27; sulphate lime, 21; sulphate of baryta, 9; total, 100.

Black.—Kaolin, 2 parts; clay, 45; calcined ocher, 43; manganese (black), 7; total, 100.

Gray pottery was manufactured extensively thousands of years ago by the Chinese and Japanese. A Japanese vase is exhibited at the Louvre, 2½ feet high and 2 feet wide, which was manufactured at Meissen by Boettcher, previous to the invention of porcelain.

BLASTING BY COMPRESSED AIR.

The risk attending the use of gunpowder or other explosives in coal mines has led to the trial of compressed air for breaking down coal, experimentally that is, and the experi-

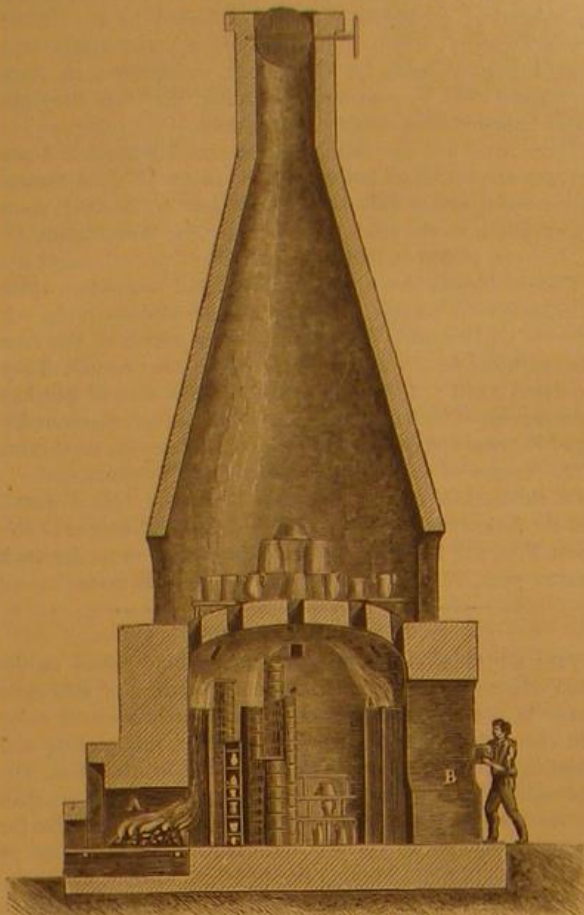


Fig. 5.—OVEN FOR BAKING AND ENAMELING.

ment seems decidedly promising. A small portable machine was used, by which two men were able to compress air so as to give a pressure of 14,200 lb. to the square inch. The compressed air was conveyed through wrought iron pipes to a cast iron cartridge, 12 inches long, placed in a hole drilled in the coal; into this cartridge the air was forced until it burst, breaking down the coal. A pressure of 9,550 lb. to the square inch was found sufficient to break down hard coal.

In a paper lately read before a meeting of coal miners, at Manchester, England, one of the inventors of this system, Mr. W. E. Garforth, of Dukinfield, expressed the conviction that before long a pressure of ten, fifteen, or twenty thousand pounds per square inch would be so utilized that they would be able to put into the miner's hands a power that would enable him to get out coal, without risk, either from blown out shots, explosions, or the production of deleterious gases.

Comparing the two systems of breaking down coal—by gunpowder and by compressed air at 8,000 lb. pressure per square inch and upward—Mr. Garforth thought that the latter would be nearly, if not quite, as expeditious as the former, while it possessed many signal advantages, especially in the matter of safety.

Remedies for Biliousness.

Dr. Rutherford says: "As yet we have found 4 grains of iridin a certain remedy for biliousness. It may be made into

a pill with confection of roses, and taken at bedtime. It produces no disagreeable sensations, and on awaking in the morning the yellow tongue is clean, and the headache and *maux de tête* are gone. As iridin, though a powerful hepatic, is not a powerful intestinal stimulant, it is well to give in the morning an ordinary mild saline aperient, such as Pülina water. Iridin, though an agreeable remedy at the time, has a somewhat depressing effect, and it probably should not be taken much oftener than once a week."

Dr. Rutherford also states that "euonymin is a hepatic stimulant in man as it is in the dog. Two grains of it made into a pill with confection of roses, and taken at night, seem to be as efficient a remedy for biliousness as iridin. If the dose be not too great it leaves no depression. A dose of a saline aperient should be taken in the morning. I have been much struck with the success of euonymin in functional derangement in several persons who had tried nearly all the commonly used cholagogues with varying and often limited success. I have no doubt that in consequence of our experiments euonymin will come to be a universally employed hepatic stimulant."

The Spectrum of Brorsen's Comet.

Professor C. A. Young, of Princeton, writes to the *New York Times* saying that Brorsen's comet has not an exceptional spectrum, as indicated by Huggins' observations of 1868, but falls into line with all the other comets. Professor Young's observations were made upon the evenings of April 1 and 2, and a comparison between the spectrum of the comet and that of the flame of a Bunsen burner showed a coincidence exact within the limits of observation.

RECENT AMERICAN PATENTS.

An improvement in oil stills has been patented by Mr. Clark Alvord, of Kendall Creek, Pa. It consists in a series of metal rods arranged permanently in the bottom of a still, and projecting downward toward the fire and upward into the oil. The object is to thoroughly distribute the heat through the oil.

An improved soldering machine, patented by Messrs. Joseph W. Miller and Bernard Coll, of Baltimore, Md., is designed for rapidly soldering the tops and bottoms of cans, pails, etc. It has novel features, which cannot well be described without an engraving.

An improved water elevator, patented by Mr. A. W. Coates, of Alliance, Ohio, is provided with a weighted

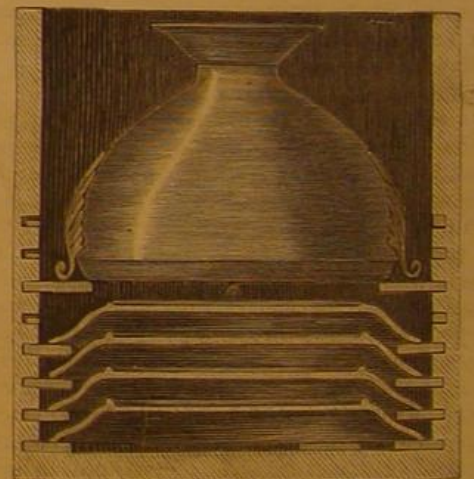


Fig. 6 INTERIOR MUFFLE.

plunger, which, by its descent, forces water up through a stand pipe.

Mr. W. E. Washburn, of Sackets Harbor, N. Y., has patented an improved hampering pad for horses, which consists of two plates, one carrying points, which stand opposite perforations in the other, when they are in their normal condition pressed apart by a spring. When the horse presses against a fence or other object with his breast he is pricked by the points.

Mr. C. S. Piersons, of Sandy Hill, N. Y., has patented an improvement in harness, which renders it stronger, lighter, and more durable, and less expensive than ordinary harness. Its construction cannot be described without an engraving.

A compact and convenient receptacle for holding flour for household use, has been patented by Mr. Joseph Johnson, of Marshalltown, Iowa. The invention consists in a cylindrical receptacle having a grid for supporting the body of the flour, and a rotary sieve for sifting it and delivering it to a chest, upon which the receptacle rests.

Mr. G. D. Elghmie, of Poughkeepsie, N. Y., has patented an improvement in men's drawers, which consists in cutting the

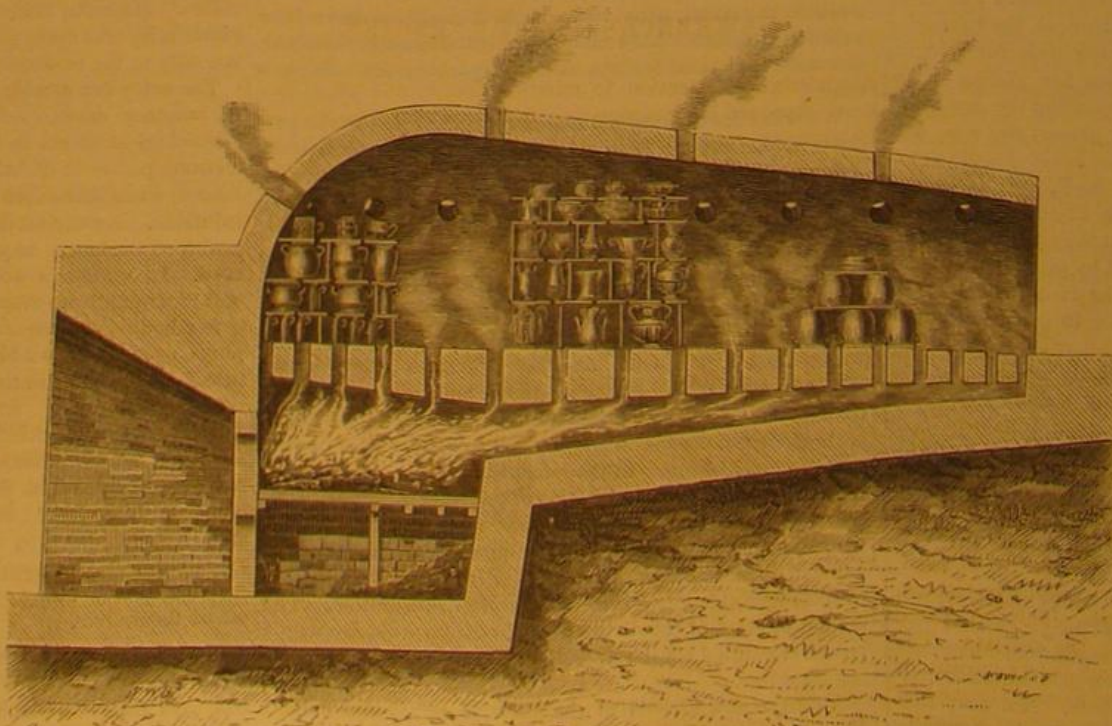


Fig. 7.—OVEN FOR GRAY WARE.

material so that each leg portion shall have a single lengthwise seam on the back. The cloth is cut on a bias to secure elasticity.

An improvement in lanterns, patented by Mr. Patrick J. Clark, of West Meriden, Conn., is designed to prevent the disturbance of the flame by currents of air, and to keep the top of the lantern cool.

Mr. Josiah Watts, of Brooklyn, N. Y., has patented a fan driven by a spring and clockwork. The stroke of the fan may be lengthened or shortened, and its velocity may be varied.

An improved car axle box lid, patented by Mr. James Seath, of Terre Haute, Ind., is fitted to the end of the oil box, which is made convex and provided at each side with tongues, which fit in grooves in the ends of the cover.

Mr. Charles H. Fuller, of Akron, Ohio, has patented an improved stuffing box for piston rods, in which the old packing may be retained, when new is added. The invention consists in a hollow gland having a conical interior, which receives a portion of the packing.

An improved windmill regulator has been patented by Enos C. Daniels, of Lyons, Ohio. The invention consists mainly in a vane which holds the windmill out of the wind, excepting when force is applied to it. It is a simple device for controlling the action of the mill.

A NOVEL ROTARY ENGINE.

We give herewith an illustration of a rotary engine of novel character, which the inventor, Mr. Lorenzo B. Lawrence, of Monticello, Cal., calls a rotary vacuum engine. It consists in an arrangement of curved tubes, A, which are open at both ends, and supported by a wheel, B, secured to a hollow shaft, and having tubular spokes, which project beyond the periphery of the wheel into the spaces between the curved tubes, A.

The hollow shaft is supported by plumber blocks, which rest upon the sides of a water tank, into which the curved tubes dip. One end of each curved tube is always left open; the opposite end is provided with a valve, I, which closes automatically as the open end touches the water. Opposite the open end of each curved tube there is a gas burner, F, which is pivoted to one of the tubular arms of the wheel, B, and is moved by a cam, G, attached to the plumber block. This burner receives gas through the hollow shaft and arms of the wheel, B. The valves, I, are operated by the same cam through the levers, J.

The pivoted burners are arranged with reference to a continuously burning stationary gas jet, L, so that the gas is let on as they come opposite the stationary jet, the latter serving to ignite the gas as it issues from the pivoted gas burners.

As the mouth of the curved tube nears the water the valve, I, is closed, and the burner, F, is turned aside, shutting off the gas supply. By the heat of the gas flame the air is rarefied in the tube, B, and as the tube strikes the water, the air is cooled, forming a partial vacuum, which draws the water into the tube causing that side of the wheel to preponderate, and inducing a rotary motion, which is continued so long as the gas is supplied and ignited in the manner described.

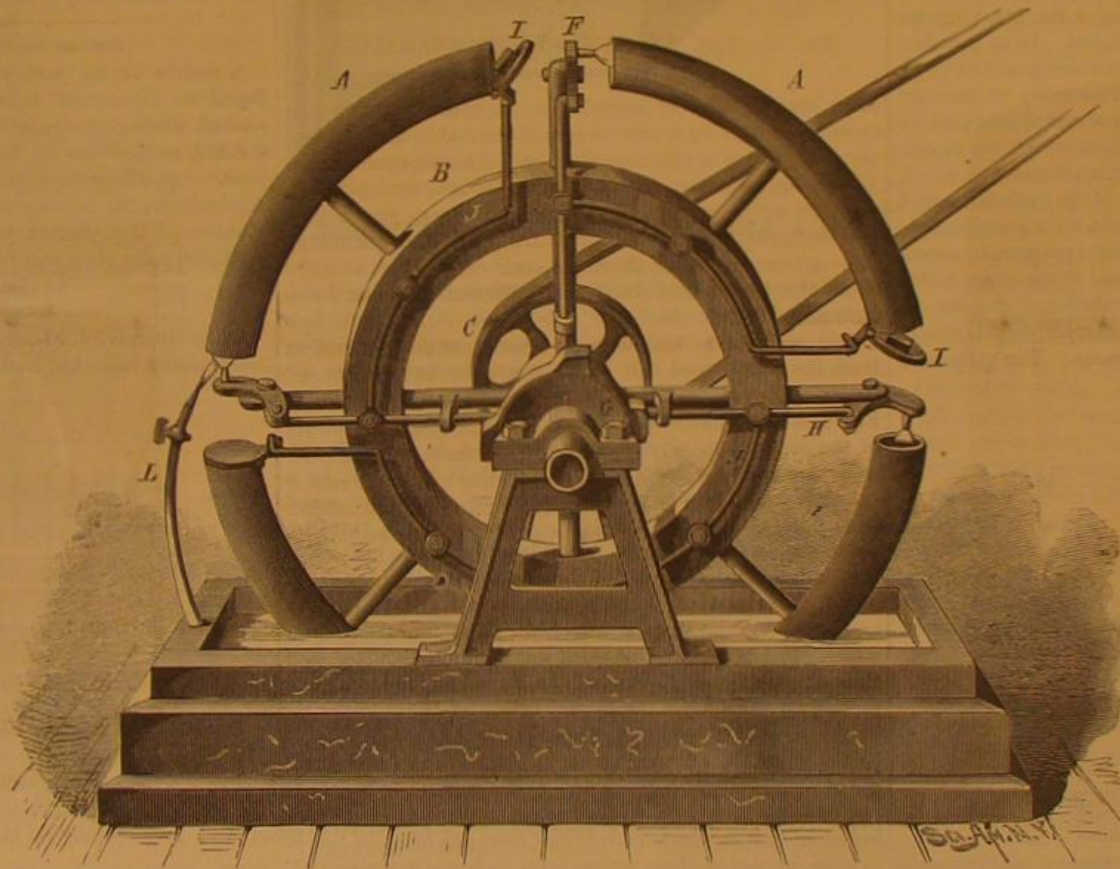
A New Explosive.

The staff of the Austrian artillery have been for some time engaged in making experiments at the arsenal of Zamky, says *Galvani's Messenger*, on a material which is said to possess far greater explosive power than any other substance hitherto discovered. During a series of investigations relative to dynamite and compressed gun cotton, M. Nobel found that the latter could be prepared in such a way that it could be completely dissolved in nitro-glycerine. The product is a gelatinous and gummy substance which, at the highest pressure, does not part with any of the nitro-glycerine. That explosive gelatine resists water, cannot be fired by any shock, but only goes off with difficulty and imperfectly when ignited. Further experiments showed, however, that with it a new compound could be formed, admirably adapted to all military purposes. This is prepared by simply adding a little camphor to the gelatine. The proportions are 4 per cent of the former to 96 per cent of the latter, which consist of 90 per cent of nitro-glycerine and 10 per cent of fulmi-cotton. The gelatinous mass is elastic, transparent, of a pale yellow color, and can be cut with a knife. When set on fire in the open air it burns like dynamite or dry compressed gun-cotton. It only takes fire at a very high temperature, and the action of the camphor

is very evident in that respect, for the ordinary gelatine by itself explodes at 200° Centigrade (392° Fahrenheit), while the heat required to produce that effect after the addition of the camphor cannot be tested by any of the apparatus usually applied to that purpose. The new composition cannot be fired by a blow, even from a projectile; it shows no sign of alteration even after having been left in running water for 48 hours. When solidified by cold it forms a mass resembling sugar-candy, and is then more sensitive to mechanical action, but as soon as it is thawed it resumes all its original properties. When exploded, however, it produces less smoke than dynamite or gun-cotton, with a clearer and more sonorous report, and has far greater force than either. The principal objection to its adoption was the difficulty of igniting it, but that has been overcome. When cotton fiber is subjected to the action of sulphuric acid, a white pulverulent substance is obtained, which has received the name of hydro-cellulose, is easily soluble in nitric acid, when it becomes nitro-hydrocellulose. This compound, mixed in the proportion of 40 per cent with 60 per cent of nitro-glycerine, forms the most powerful means of ignition ever hitherto discovered. By properly constructed firing-cartridges of that substance the explosive gelatine becomes as manageable as ordinary powder, with less danger and far greater expansive force.

A Thriving State.

In reporting on the iron and steel industries of Belgium, as represented at the Paris Exhibition, Assistant Commissioner J. D. Morrell says that there is something amazing in the comparative prosperity of the Belgian iron and steel industries, when their spare natural resources are taken into consideration, and when the same industries of more favored countries are experiencing a greater or less depression. The causes for this condition of things, Mr. Morrell says, are to be found in cheap labor, long hours, the technical education of workmen, strict economy in



LAWRENCE'S ROTARY ENGINE.

administration, attention to minutest details, and use of the most improved labor-saving machinery. The population of Belgium is very dense, 5,000,000 people inhabiting 12,000 square miles of territory. The country is a hive of industry. There is no room for drones. Every man has his work to do, and he must be content with small wages, for high wages would soon put an end to all employment by destroying the ability of Belgium to compete in foreign markets. Strikes are exceedingly rare, and when they do occur they are soon terminated, because the Government will not tolerate them. Personal economy is essential to existence. The labor of women and children is utilized. Railroads through its own territory, favorably situated seaports, and a trading spirit handed down from the middle ages, aid in securing foreign purchasers for Belgian manufactures. Belgium utilizes all her resources. She is industrious and frugal. She neglects none of her opportunities. Mr. Morrell concludes this portion of his report by the remark that much of the distress existing in other countries might be obviated by the practice of the same virtues, and that it would not involve the reduction of wages to the Belgian standard.

Profits on Beer and Milk.

According to the English newspapers, the depression of trade in Great Britain does not extend to every industry. The celebrated brewers, Bass & Co., it is stated, divided as profits for the year 1878 the almost incredible sum of £400,000. The Anglo-Swiss Condensed Milk Company, it is also stated, divided a profit of £60,000. The alarm in

London respecting the milk served from infected cows, it is said, has largely increased the trade in condensed milk within a short time.

It would seem, therefore, that while the metal trades and some of the other important industries of the country are greatly depressed, the articles of food and drink are paying a good profit to the dealers.

Iron in New Zealand.

The Government of New Zealand has, within a few years, constructed more than one thousand miles of railroads within its colony, all the material for which, except the sleepers, having been transported, at heavy cost, from England. The present Minister of Public Works, Mr. James MacAndrew, has undertaken the experiment, with a view of promoting the iron industry of the colony, of advertising for proposals for one hundred thousand tons of steel rails, to be made from the native ores of New Zealand. In addition to the advertisement in another column, a pamphlet has been printed by the Government containing maps and diagrams, which may be had from Sir Julius Vogel, Agent of the Colony, on application at 7 Westminster Chambers, London.

Around the World in Thirty Days.

In a letter to the *Herald* detailing some of his plans for the coming summer, Mr. Samuel A. King, the aeronaut, says that during his thirty years' study of aerial navigation, in the course of which he has made somewhat over two hundred ascensions, without injury to life or limb, he has steadily endeavored to avail himself of whatever experience or suggestion might afford to make traveling in the air practical, definite, and useful. Numerous and often costly experiments have shown him that, with no mechanical appliance or power yet discovered, is it possible to journey definitely and with certitude through the air to any previously designated point, in opposition to the direction of a prevailing wind. The balloon, therefore, remains to-day what it was in the days of the Montgolfiers, a machine that all the skill and ingenuity of man cannot prevent from floating with the wind, which controls and directs it absolutely from the moment it is launched. The application of any known mechanical power, to be of any use as against a wind directed upon the vast surface of a balloon, is entirely impracticable in consequence of the weight involved. Mr. King is confident, however, that a great deal can be accomplished with the balloon, slave to the wind though it be, and that it is possible to operate them so as to greatly prolong their carrying ability. As the result of a long series of experiments Mr. King speaks confidently of his ability to make a balloon voyage of a month's duration, a time sufficient, with a thirty-five mile breeze, to circumnavigate the globe; and he claims to have demonstrated to his own satisfaction that it is not only feasible to construct a balloon that will maintain the bulk of its lifting power, but that it is also easily practicable to keep it afloat and in transit for this length of time.

Mr. King proposes to operate during the coming summer a spheroidal (captive) balloon, having a diameter of 65 feet and a capacity of 150,000 cubic feet, inflated with hydrogen, maintaining a second balloon of like dimensions as a reserve in case of accident. If his experiments with these are satisfactory he proposes to construct an air ship double the size of his captive balloon, for a transatlantic voyage, to be undertaken "in earnest," some time in 1880, following the well-established storm path on which the *Herald* bases its European weather forecast.

The Sizes of Ferments.

The *Brewer's Guardian* has compiled from trustworthy authorities the following table, showing the sizes of the various ferments found in beer and other fermented liquors:

	Diameter of the Cells in Fraction of an Inch.
<i>Saccharomyces cerevisiae</i>	00031 to 00035
" <i>minor</i>	000315
" <i>ellipsoideus</i>	00024 by 000176
" <i>pastorianus</i>	00007 by 00035
" <i>exiguus</i>	00008 by 000118
" <i>apiculatus</i>	000236 by 000118
" <i>mycoderma</i>	000118 to 000787
Viscous ferment	000047 to 000055
Lactic "	0000084
Butyric "	0000087 by 000087
<i>Mycoderma aceti</i>	000059 by 000118

EDISON'S ELECTRO-CHEMICAL TELEPHONE.

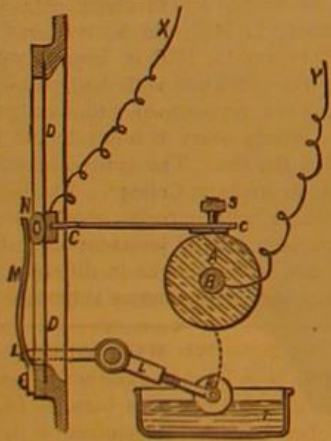
Mr. Edison has recently improved his carbon telephone so much that in conjunction with a magnetic receiver it far surpasses for power and clearness of articulation every other system of telephone that has been introduced.

As long, however, as there was in connection with the instrument no more powerful receiver than the Bell telephone or instruments of similar principle, the carbon telephone, although possessing many points of superiority over other systems, was limited in its power to the capabilities of the receiver with which it was connected, and until quite recently no receiving telephone had been introduced which would develop or do justice to the power of the carbon transmitter.

Mr. Edison has now applied, with remarkable success, the principle of the electro-motograph to the construction of a telephone receiver, which, on account of its extraordinary power and perfection, must before long supersede the feeble instruments of other systems, and secure to itself a great commercial future. No one who has heard this new telephone can fail to have been astonished at its clear, articulate, and loud tones; it might appropriately be called "The Shouting Telephone," for its "voice" is louder than that of any ordinary speaker, and we have failed to distinguish any difference in clearness of articulation between its utterances and those of a person engaged in conversation. Where it is in use it is of course unnecessary to go at all near the instrument, for it may be fixed against the wall of an office, and its messages heard at any part of the room spoken in a loud clear tone, and even the high notes of whistling are reproduced with such perfection as to make it almost difficult to believe that some one in the room is not whistling loudly near the instrument.

This extraordinary instrument, which is illustrated in Figs. 1, 2, 3, and 4, consists in its simplest form of a diaphragm which is set into vibration by the variations of friction taking place between a metallic strip and a chemically prepared rotating cylinder, under variations of the strength of an electric current passing at the point of contact of the metallic strip and the cylinder. In its simplest form the apparatus consists of a cylinder composed of chalk and potassium hydrate with a small quantity of mercury acetate moulded round a flanged roller or reel of brass, which is lined with platinum on those surfaces which are in contact with the mixture, which is kept in a moistened condition. Upon the upper circumference of the cylinder, which is caused to revolve on a horizontal spindle, a metallic strip is caused to press with a firm and uniform pressure by means of an adjustable spring. The portion of the strip which bears upon the cylinder is lined with platinum, and the opposite end is attached to a diaphragm of mica, four inches in diameter, firmly fixed by its circumference. The cylinder is

FIG. 3.



connected to the copper element of a battery, and the strip to the zinc pole, with a transmitting telephone included in the circuit. If, when no current is passing through the instrument, the cylinder be rotated at a uniform speed away from the diaphragm, the friction between the cylinder and the strip causes the diaphragm to be drawn inwards, that is, toward the cylinder, and the diaphragm would take up a fixed position dependent upon its own rigidity and the friction between the cylinder and the strip. The instant, however, that a current is transmitted through the instrument that friction is reduced and the diaphragm flies back by its own unopposed elasticity, the variation of friction being proportional to the variation of the strength of the electric current; and so marvelously sensitive is this combination that the variations in the strength of the electric current caused by the human voice speaking against a carbon transmitting telephone instantly produce their corresponding variations of friction, and the diaphragm repeats the words, but very much louder than they were originally uttered at the distant station.

Fig. 1 is a perspective view of the apparatus, which is in reality three instruments in one, combining a transmitter, receiver, and call bell, and, therefore, has a somewhat complicated appearance. The whole of the upper portion, however, is the call bell and signaling apparatus, by which attention is attracted at the other station, and by which such calls are received; this differs in no respect from an ordinary electric bell, having a key and switch by which it is thrown into circuit. In front of the box, which is of cast iron, is seen the large diaphragm, but even this has a more compli-

cated appearance, in consequence of the transmitting carbon telephone being fixed in front of, and concentric with it. If the transmitter and call bell apparatus were removed, the

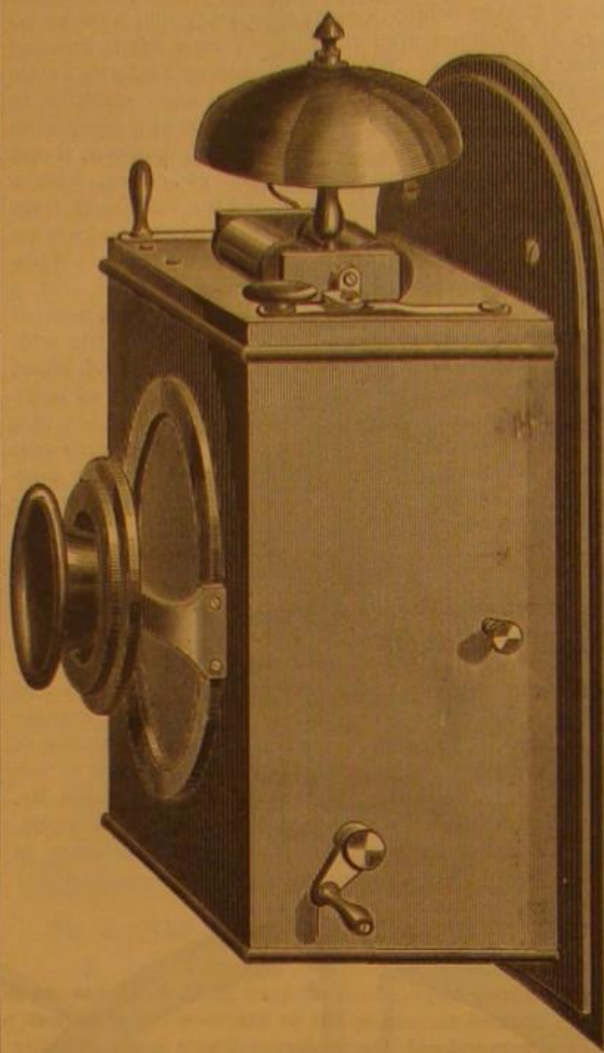
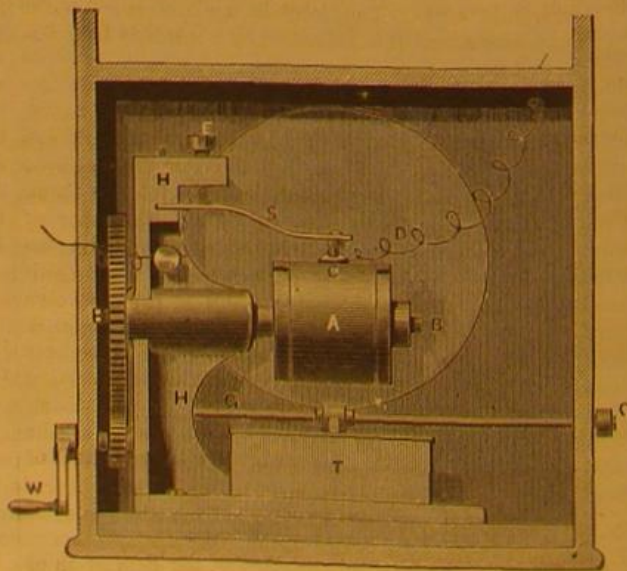


FIG. 1.—EDISON'S ELECTRO-CHEMICAL TELEPHONE.

external appearance of the receiver would resolve itself into a rectangular box, having a 4 inch hole in its front face glazed with mica, and a small winch handle projecting from the right hand side. The internal arrangements are shown in Fig. 2, which is a back view of the interior, and in Fig. 3, which is a vertical section taken through the center of the diaphragm. Referring to Fig. 2, A is the chalk cylinder mounted on the horizontal shaft, B B, which, by a spur wheel and pinion, can be rotated at a moderate speed by turning the winch handle, W. The spindle, B, turns in, and is supported by the long boss bearing shown in the figure, and which forms part of the cast iron bracket, H H, to which every part of the apparatus, except the diaphragm and its connected strip, is attached. D is the diaphragm, which consists of a disk of thick mica, 4 inch diameter, and C is a metallic strip attached to its center, and which is pressed tightly against the upper portion of the cylinder by means of the stiff spring, S, whose pressure can be regulated by the screw, E. A comparison of Figs. 3 and 4 will make the arrangements of parts clear. G is a countershaft, which can be turned through a small angle by depressing a lever keyed on to it on the outside of the case; the effect of this is to raise, by means of the forked lever, L L, the damping roller, R, against the surface of the chalk cylinder, and so occasionally to supply the water which is lost by evaporation. The roller, when not in use, rests in a trough of water, T,

FIG. 2.



and has only occasionally to be raised when the cylinder becomes too dry to give the best results. When this instrument is connected to a carbon telephone, with no greater battery power than two Fuller cells, any sound uttered into

the transmitter is not only perfectly reproduced by the mica diaphragm, but its sound is so greatly increased as to constitute what in a speaker would be considered an unusually loud voice.

Mr. Edison has found that this instrument, like the magnetic receiver, produces far more satisfactory results when working on an induction circuit than when it is connected directly with the carbon transmitter; he therefore adopts the plan of placing the receiving instrument in circuit with the secondary wire of an induction coil, the transmitter and battery being on the primary circuit. Fig. 4 will explain how the connections are made for a single pair of instruments. In this diagram T is the carbon transmitter and R the electro-chemical receiver, B is the battery, and C an induction coil. The undulatory character which is given to the voltaic current by transmission through the carbon disk, whose resistance is continually varying under the influence of sonorous vibrations, produces by induction a correspondingly undulatory current in the secondary circuit of the induction coil, C, and this varying current being transmitted by the line wire to the receiving instrument, by varying the intensity of electro-chemical decomposition going on between the chalk cylinder and the platinum point which presses on it, causes a corresponding variation of the coefficient of friction between the two surfaces.

The secret of the great power of the instrument, by which it speaks with a voice to be distinctly heard all over a large room, is that the mechanical motion of the diaphragm is produced not by the electric current, as in all other telephone receivers, but by local mechanical means, such as a train of clockwork or rotation by hand; the electric current merely controls the time when that mechanical force is exercised, and the amount which is brought into play. It may, mechanically, be compared to a frictional coupling or clutch through which a machine is driven by a steam engine, and which at any moment may be made to transmit the full power of the motor to the machine, or by varying the friction to transmit only a portion of that power.

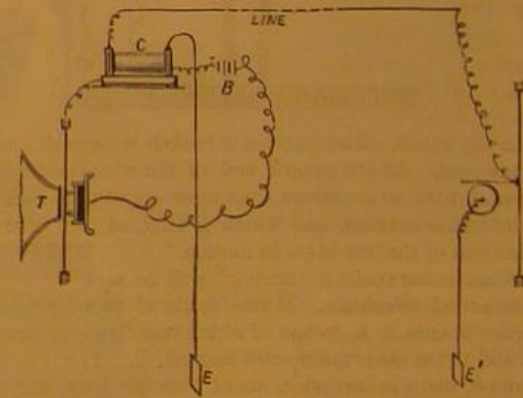
Swine in the United States.

A review of the pork packing season in the West, published in Cincinnati April 3, shows the number of hogs packed during the year ended March 1 to have been 10,858,692, an increase of 1,810,126 head over the preceding year. According to a statement of the Commissioner of Agriculture, the number of hogs in the country at the beginning of the present year was nearly 35,000,000; over 2,500,000 more than was reported the year before.

Snakes as Pets.

Of all ungrateful, ill-conditioned, disagreeable reptiles, the black snake takes the lead, and, with the exception of the

FIG. 4.



common water snake, is the most pugnacious of all serpents I ever handled; it would bite fiercely when caught, and, further, it would bite in captivity whenever the temptation offered. We could not tame it to any extent until, by beating it smartly and repeatedly, we at length succeeded in getting it to a state of sullen, reluctant decency. Its bite caused some blood to flow, but otherwise amounted to nothing. The water snake (*Nerodia sipedon*) was as snappish and unappreciative of kindness as the black snake, would bite when first captured and also afterward during captivity, though in this latter state not always, but as the caprice seized it. The copperhead (*Ancistrodon contortrix*) we had only in two instances. One was brought to us half dead, and died the same evening. The other we captured alive by placing the foot (well booted) on the reptile's neck, and inserting the snake by degrees into a box. It was always an uncivil, untamable animal, utterly indifferent to the comforts and allurements of civilized life. We contented ourselves with letting him alone and looking at him through the wire gauze front of his box. A large rattlesnake (*Crotalus durissus*) was sent us from the Blue Mountains, but it had been so long in captivity before reaching us that all the spirit was out of it. It had large fangs, but never showed any disposition to use them, and though we took it from its box a dozen times a day and handled it sometimes not over delicately, still it never resented any of these liberties. Twenty-five years have since passed away, yet, when I now think of our temerity in this instance, it is never without a shudder. What I did then with impunity I would not now repeat for a million of money.—*Science News*.

Correspondence.

A Telephone Twenty-eight Years Ago.

To the Editor of the Scientific American:

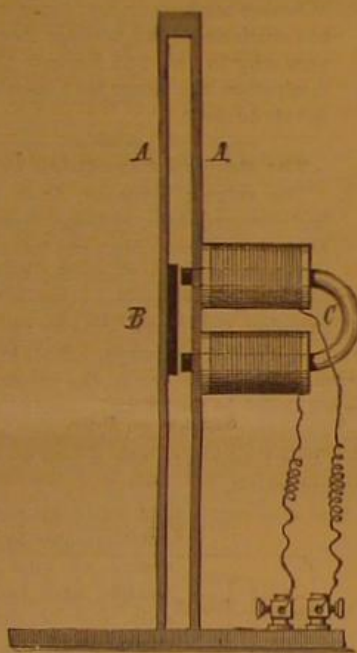
Will you allow me to call attention through your valuable paper to some early work relating to the telephone, which those who know of it regard as quite important in the history of this invention?

In the latter part of 1851, Mr. Edward Farrar, of Keene, N. H., quite recently mayor of that city, was occupying leisure moments in trying to transmit sounds over a telegraph wire, and actually succeeded in telegraphing music, and used a true telephone as a receiver!

His friends have been for some time desirous, in the interest of science, that his work should be more widely known, and in his own modest silence, I have obtained his permission to make the statement of it.

Some three years after his first actual telephonic success he had a correspondence with the Professors Silliman, of Yale College, with view of pursuing his work farther, but the replies he received were of such nature as to lead him to suppose that further attempt was hopeless, and under that impression and pressure of professional duties he laid it aside. I have before me some of that correspondence, and will quote from one of Mr. Farrar's letters a description of his experiment, and a statement which shows how closely he came to inventing a complete speaking telephone:

"Each reed of a melodeon is furnished with a small metallic point, which, while the reed is at rest, approaches near to the surface of mercury in a very small cup underneath the reed, into which the point dips when set in motion. The reeds are connected with one pole of a battery, and the cups



with the other. The current is broken with each vibration of the reed. At the remote end of the wire is a temporary magnet, with an armature fixed upon a spring in near proximity to the magnet, and which is affected as a reed at the other end of the line is set in motion."

What he here calls a "spring" will be seen by the figure to be a real telephone. It was made of two upright thin spruce boards, A A, to one of which was fixed the armature, B, and to the other the electro-magnet, C. The boards were seven or eight inches wide, about two feet long, and placed half an inch apart, and joined at the top by a strip glued between them.

He continues—"The effect is that the armature vibrates with the reed set in motion, and, the pitch of a sound depending on the rapidity of vibration, it will be the same in the reed and armature. A tune on the instrument will therefore produce a tune on the armature. What may appear somewhat strange, several different tones may be heard when chords are struck upon the instrument."

"The object of my inquiry was this. If the current power could be varied by some slight variation of a vibrator to be affected by the atmosphere as the tympanum of the ear is, the supposition is that the sounds of the voice might be reproduced by the means stated above!"

When it is remembered that Mr. Farrar penned the above in May, 1854, it is to be regretted that he was turned aside from so interesting an inquiry at so critical a point, and that he did not take that one step which would have then produced the speaking telephone.

We believe Reiss' telephone was made in 1861, ten years later than Mr. Farrar's. Can any earlier work than his be named?

S. H. BRACKETT,

Teacher of Natural Science, St. Johnsbury Academy,
St. Johnsbury, Vt.

The Fast Ice Boat.

To the Editor of the Scientific American:

Fifty-two or fifty-three years ago the past winter, Mr. Daniel Bray, then of Richmond, Ontario county, N. Y., a boy about 16 or 17 years of age, constructed an ice boat which was successful in all respects. It was used on Honeoye Lake, in that county, and is said to have run at the rate of a mile in a minute, when the ice was in good condition and the wind fair. It was built as follows: He used

a light, flat bottomed boat for the body, to guard against accidents that might ensue from running into air holes. Underneath this and about one-third the distance from bow to stern, he placed a plank crosswise, about sixteen feet long, which he securely fastened to the boat, and to each end of this plank was fastened large flat bottomed skates, the inner edges being a little the highest. A heavy stout rudder was next attached, on the inner edge of which was also fastened a large skate, but this was creased in the center. Sails, same as now used for sailing on the water, were supplied, when our young voyager was ready to "fly with the wind." I have heard eye witnesses and those who have rode in it say it could be run faster than the wind blew. I also notice in your paper of a recent date, a cut of a velocipede sleigh, the exact counterpart of one made by Mr. Bray thirty years ago, and used by the writer when a boy. J. B. B.

Steamboat Smaller than the "Nina."

To the Editor of the Scientific American:

That "smallest steamboat in the world" is larger than one made and used years ago by S. H. Roper, of this city (inventor of the Roper Caloric Engine). Roper's boat was 14 feet long, 17 inches wide, 12 inches deep, made of $\frac{1}{4}$ inch cedar; and after going about the harbor and four miles to sea, as far as Nahant, he would take it on his shoulder and carry it home.

The boiler, of 1-20 inch steel, was 8 inches diameter, 18 inches high, vertical, 63 tubes, and carried 250 lbs. steam; cylinder, 1 inch diameter, 2 inch stroke; screw, 12 inches; speed, 8 to 10 miles per hour. The boat drew 2 inches of water without passengers. Screw set at an angle.

The engine was condensing, and one gallon of water was a supply for one day. A rotary gear pump fed the boiler, sometimes against 300 lbs. pressure. The same engine was used on a velocipede to travel about the streets upon. The condenser was a pipe, which formed the keel of the boat. The fuel used was wood, about $2\frac{1}{2}$ bushels of maple for a day's trip. Smokestack, 5 feet high. G. B. G.

Boston, March 14, 1879.

The Circle not Squared.

To the Editor of the Scientific American:

Referring to your issue of April 19, Q. E. D. has not only not squared the circle, but he has shown that he does not even comprehend the problem. There is no difficulty in finding the area of a circle, and no difficulty in finding the side of a square of exactly the same area. The pith of the famous problem is to find by a regular geometrical construction a line whose square shall be equal to the area of the given circle. And this Q. E. D. has not done. Rolling a circle on a plane is no more a geometrical process than finding the circumference of the circle with a piece of tape. New York, April 10, 1879. A. B. C.

ENGINEERING INVENTIONS.

An improved steam boiler having an annular water space and an inner cylindrical receptacle through which the flues pass, and having the inner and outer water spaces connected at intervals at the top and bottom, has been patented by Mr. William Hopkins, of Dubuque, Iowa.

Mr. George H. Cobb, of Palmer, Mass., has devised a novel automatic cut-off for steam engines, which consists in a sliding cam of peculiar shape, which rotates with the engine shaft and is moved by the governor. This in connection with the usual eccentric gives the required motion to the slide valve of the engine.

An improved gauge cock, capable of indicating the height of the water in the boiler through a wide range, has been patented by Mr. Joseph B. Leger, of Handsborough, Miss. The principal feature of the invention is a curved tube, which projects into the boiler, and may be turned up or down to the surface of the water. The discharge tube at the outside of the boiler projects in the same direction and for the same distance as the inner tube, and serves to indicate the height of the water.

Mr. Andrew Harvey, of Detroit, Mich., has patented an improved accessible joint, valve, and trap protector for underground pipes. The joint is made large enough to admit a person, and it is accessible by a manhole from the surface of the ground.

The Tables Turned.

It is not many years since the freighting of Atlantic steamers was almost wholly this way. We were importing heavily from Europe, and with the exception of cotton we sent little or nothing in return. In a recent letter to the London Times, Mr. David McIver, member of Parliament for Birkenhead, and one of the owners of the Cunard line of steamers, declares unhesitatingly that from his own experience as a carrier, he does not know of any nation whose trade prospects at present are so gloomy as those of Great Britain. The depression in the United States and elsewhere does not at all approach the depression there. The British exports to the United States are comparatively nothing, either as regards volume or value. The British food importations are steadily increasing, and the balance of trade is so overwhelmingly against Great Britain that he sees nothing except ruin in prospect for home industries, whether manufacturing or agricultural, if the present state of things is allowed to continue. The export trade from Liverpool to the United States is so small that whenever the restrictions on the importation of United States cattle are removed, gentlemen who are prepared to put additional steamers into the

trade deliberately intend to make the outward voyages with water ballast only, without joining in the scramble for the little outward freight which other owners have been recently carrying as ballast at merely nominal rates.

PREMIUMS FOR BOYS.

The disposition of farmers' sons to escape from farm labor at the earliest possible moment is doubtless due less to the nature of the work than to the fact that farmers' boys are usually expected to work as a matter of course, and without any personal interest in the result. His efforts receive no special recognition or reward, and few opportunities are offered him for personal distinction or profit.

Mr. Stillman B. Allen, of York county, Maine, believes that much good might be done by taking more account of boys' labor on farms, and sets a practical example by offering a series of premiums to the boys of his county, for individual efforts in farming. Thus, to the boy (under sixteen) who shall raise the most Indian corn on one eighth of an acre of land during the coming season, he offers a premium of \$100. To the boy who shall raise the next largest quantity, \$50, and to the five boys who shall raise the next largest quantity, \$10 each.

The conditions are easy, and the awards are to be made by the President of the County Agricultural Society. At the end of the season each contestant will have to make and sign a full report, giving the shape, description, and location of land, when planted, when and how many times hoed, when stalks were topped, if at all, when harvested, and how much is raised, and as nearly as can be estimated, the value of manure, and number of days' labor spent upon the crop, excluding the husking, when he may have all the help he wants from the boys and girls in the neighborhood.

The example set by Mr. Allen is worthy of being widely followed, not only for the immediate effect in heightening the interest of boys in farm work, but for its indirect effect in raising the standard of such labor. The boy that has learned by actual trial that it is possible, by careful cultivation, to get from an eighth of an acre as large a crop as the average farmer gets from twice or thrice the ground, will not soon forget the lesson.

Collection of Meteoric Specimens.

Mr. Charles B. Shepard, of New Haven, Conn., has accumulated, it is believed, the largest collection of meteoric stones in the United States, if not in the world. The collection embraces more than five hundred meteoric stones and meteoric irons. The total weight of the collection is about twelve hundred pounds. The largest iron, procured from Colorado, weighs 436 lbs., and the smallest, from Otsego county, N. Y., weighs half an ounce. The largest entire stone, procured from Muskingum county, Ohio, weighs fifty-six lbs., and the smallest one, from Sweden, weighs less than fifty grains. The specimens have been gathered from all parts of the world. The catalogue begins with one which fell November 7, 1492, in Alsace, and ends with one which fell February 12, 1875, in Iowa county, Iowa. There are none between 1492 and 1753, but most of the years since the latter date are represented and some years by several specimens. Nearly every country in the known world is represented in the list. The entire collection is in one of the buildings in Amherst College. Mr. Shepard makes one statement which will surprise most persons. He says: "There have been several instances of death occasioned by meteoric stones. Two monks in different places were thus killed in Italy, and two sailors on shipboard in Sweden."

Heinrich Wilhelm Dove.

Heinrich Wilhelm Dove, the celebrated meteorologist, died April 5. Professor Dove was born at Liegnitz, Prussian Silesia, October 6, 1803. He studied at Liegnitz, Breslau, and Berlin. In 1826 he became a teacher, and afterward a professor extraordinary in the University of Königsberg. In 1829 he was invited to a similar chair in Berlin. In 1837 he was admitted to the Academy of Sciences, and in 1845 became a full Professor of Physics. He distinguished himself by his researches in electricity and meteorology, and published various works upon these subjects. His reports and isothermal maps afforded the first representation of the isothermal lines of the whole globe for every month of the year. He was the first to announce the presence of a secondary electric current in a metallic wire at the moment that the circuit of the principal current is completed. He was Director of the Prussian Observatories, and made many useful reports. He began in 1837 the publication of "A Complete Repertory of the Physical Sciences," in which he was to be assisted by the most eminent men of science; but the progress of the work was interrupted. His book on the distribution of heat on the surface of the globe has been translated into English.

Diphtheria in Fowls.

A fatal disease prevailing among fowls at Marseilles is described by Nicati and Garard to be very like diphtheria. Thick false membranes of yellowish color covered sometimes the mouth and the pharynx, sometimes the eyes, in one case they were found reaching into the bronchi, and affecting the lung. One hen died the day after the first symptoms appeared, others in three and five days, while some remained ill for weeks. The hen so attacked utters a peculiar kind of cry, opening its beak with difficulty. Symptoms of a similar nature have still more recently been observed by M. Nicati in a pigeon house in Marseilles.

A CONVENIENT BOX FOR ARTISTS.

The accompanying engraving shows a novel and convenient box for artists' use, recently patented by Mr. William H. Brownell, of Brooklyn, N. Y. It answers the double purpose of a receptacle for palette, colors, and other tools and materials, and of an easel for supporting the board canvas or tile upon which the work is to be done.

The box, as will be seen by reference to the engraving, consists of four sections, hinged together alternately at opposite ends, and capable of closing compactly together so as to be readily carried by the handle.

When the box is opened for use it presents the appearance shown in the engraving. Everything contained in it is accessible, and it holds the board or tile firmly and in a convenient position. A pin is provided for holding the rest stick, and the whole affair seems well adapted to suit the needs of artists either in the field or studio.

American Petroleum in Europe.

A dispatch received by the Department of State from Mr. James R. Weaver, United States Consul at Antwerp, calls attention to the serious and growing dissatisfaction now felt in Europe with regard to the quality of refined petroleum imported of late from this country, and expresses fears that unless some satisfactory explanation thereof be given, the government of Belgium will be called upon to restrict the importation of refined oil by the imposition of a heavy duty, or prohibit it altogether unless it comes up to a high fixed standard. Either of these regulations would be disastrous to the American petroleum trade. An expert sent to Europe by one of the largest of the American oil refining companies to investigate the complaints says that the difficulty does not arise from imperfect refinement of the oil, but from the fact that the oil now obtained, particularly in the Bradford district, differs materially in its characteristics from that heretofore exported, especially in specific gravity, and requires different wicks and burners. He affirms that the oil now produced is no more liable to explosion than the earlier quality, and that it cannot be improved by more thorough refinement without great additional cost. The whole question is about to receive special attention at Bremen, where a general assembly of delegates from various parts of Europe will shortly be convened to consider the complaints and difficulties, and decide upon such remedies as the circumstances demand. Mr. Weaver warns American refiners and exporters that unless they take some steps to remove the present dissatisfaction, there is great danger that they will lose a large part of their present European trade.

A NEW CARBURETER.

The problem of economical artificial illumination has of late received more than ordinary attention; but the entire effort seems to have been in the direction of electrical lighting; quite recently, however, an apparatus has been patented which looks toward the solution of the problem in another way. We refer to Messrs. Pew & Wearts' carbureter, shown in the accompanying engraving.

This machine, which the inventor calls the "Eclectic Gas Machine," is designed to produce an illuminating gas from a light hydrocarbon by the admixture of a suitable quantity of common air, or it may be used to enrich the ordinary illuminating gas. The machine is quite simple in its construction, although the few wheels shown give it the appearance of complication. There is, however, nothing fine or intricate about the gearing; it is driven by a weight, and its sole office is to work two small diaphragm air pumps, A, B, through the medium of the crank, connecting rods, and working beam. These pumps force air through the regulator, C, into the large reservoir above. When the maximum pressure is reached the raising of the flexible diaphragm in the regulator carries upward the brake lever, D, bringing a brake against the fly wheel, E, and stopping the action of the pumps. When the pressure diminishes, the brake falls away,

and the mechanism is permitted to operate again. The reservoir is divided by hollow perforated or wire gauze partitions, the outer spaces of which are filled with a fibrous or porous material that absorbs the hydrocarbon and delivers it to the air as it passes through. By means of this arrangement a large surface of hydrocarbon is exposed to the air passing through the apparatus without the necessity of keeping in the reservoir a large quantity of the liquid. It is

**ARTIST'S BOX.**

stated that this apparatus effects a saving of over eighty per cent in the expense of lighting.

Messrs. Pew & Wearts inform us that at a recent test in the Western Union Telegraph Office, Philadelphia, the gas meter registered one foot per hour for each burner, instead of the usual six feet, or only six hundred and twenty-five feet, during five tests of five hours each, as compared with

Neglect of Rest a Cause of Drunkenness.

In the opinion of Dr. Jackson, "the refusal to take proper physical rest, when tired from labor, is one of the most important and powerful in inducing a love for and an indulgence in the use of ardent spirits. Men work till they get so tired that they cannot wait to feel sensibly rested by processes of change going on in their systems from suspension of labor. They either want to work more hours than they are able to do; or when they have done as much as they feel themselves at liberty to do, they are so tired that they cannot rest. They get rest, therefore, in artificial ways, by resorting to eating and drinking. Some get rested by drinking tea, others by drinking coffee, others by chewing and smoking tobacco; but the great majority of tired people in this country—and the larger share of our people are tired—drink ardent spirits in some or other of its forms or preparations. They fall back on stimulants instead of the intrinsic vitalities of their bodies. They therefore are lifted up into false conditions. Accepting these as true, they keep on working till they become so functionally impaired as to induce positive inability to work longer, or they become so constitutionally depreciated as to be smitten with incurable disease."

There can be no doubt that the neglect of physical rest is, as Dr. Jackson asserts, the occasion of much over-frequent resorting to alcoholic or other stimulants; but it is not by any means apparent that too long-continued work is the only or the main cause of the deficient rest which results so disastrously. Whether workers or not, those who stimulate too much do so not because they have no opportunity to rest, but because they spend in dissipation the hours they should and could devote to sleep.

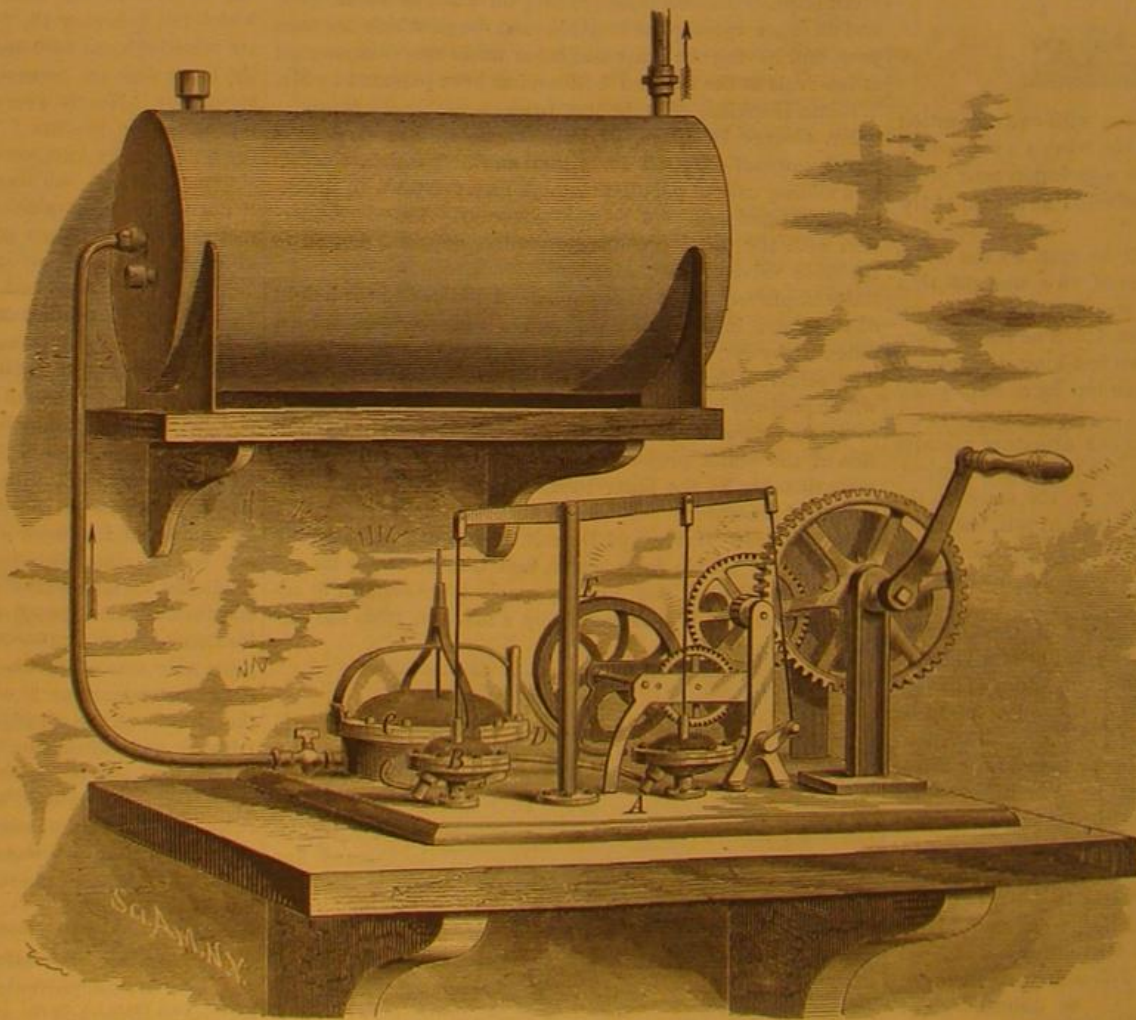
The Balloon Expedition to the Pole.

The veteran aeronaut, Prof. John Wise, has removed his residence from Lancaster, Pa., to Louisiana, Mo., and he communicates to the *Kansas City Times* the following letter regarding Commander Cheyne's plan for reaching the North Pole by the use of balloons. The venerable Professor says: "Nothing could give me more pleasure than to be one of the explorers. I have such a confirmed belief in the habitableness of the Polar archipelago, and of its uniqueness as to climatic and comfortable conditions, that I believe no one would want to get out of it that ever got into it."

We know that it is surrounded by an ice wall that is insurmountable by all ordinary means of land and water vehicle, and hence the air ship will be the successful craft. Beyond the eighty-second parallel no human foot has yet trodden, unless it was Kane, in whose time the world was not yet obliterated so much as to present the condition of a basin that receives the sunbeams in half the year against its glacial sides. The earth of necessity is becoming more obliterated all the time, if there is any truth in the law of motion as we comprehend it, and whatever theory we may adopt as to its original formation, whether by slow nebular accretion or by sudden condensation of cometary matter, it is a plastic body, and does conform itself to the law of centrifugal and centripetal conformation.

An electrical mystery surrounds the North Pole region, something in the nature of the coil magnet, from which such amazing developments proceed in the mode of light and electric magnet machinery that draws the attention of the scientific master minds of the day.

For over a hundred years the most daring and persevering efforts have been made to enter this basin. That it must be an archipelago, the shape of the earth and its mo-

**PEW & WEARTS' CARBURETER.**

seven hundred and fifty feet, the amount usually consumed.

This system is covered by three United States patents, issued since the first of the year to Mr. Pew.

For further information address Messrs. Pew & Wearts, 239 Broadway, New York.

tion, in connection with the equatorial heat in air and water, do strongly attest; and that it must be a delightful country, the circumstances of its existence verify. It cannot be very cold in the long winter night, as there must be a humid atmosphere pervading it from the pouring in of the equatorial heated submarine gulf streams. Nature is sufficient for all

and any necessity to the existence of animals, and what of it is human's should be disposed of by hibernation for three or four months in the year. Why, Mr. Editor, it does me good just to think of the thing, and to go into it would more than rejuvenate me for another three-score and eleven.

JOHN WISE.

Elm Cove Cottage, near Louisiana, Mo., April 2, 1879.

IMPROVED BARREL FOR BREECH-LOADING SHOT GUNS.

The accompanying engraving represents an improvement in rifle barrels for breech-loading shot guns, recently patented by Mr. Joshua Stevens, of Chicopee Falls, Mass., Fig. 1 being a perspective view showing the gun and attachment; Fig. 2 shows the breech of the rifle barrel; and Fig. 3, a longitudinal section of the same.

The rifle barrel, B, is fitted to the shot gun barrel, A, and provided with a longitudinal recess for receiving the slide, D, in which is pivoted a lever, E, having at its rear end a short projection, c, extending inward. The rifle barrel, B, is inserted into the rear end of the barrel of an ordinary breech-loading shot gun, the flange formed on the end of it entering the recess made in the shot gun barrel for the reception of the cartridge flange. The cartridge is now inserted and the gun is used in the ordinary way. After the discharge the barrel of the gun is tilted down, and the extractor starts the rifle barrel out of the shot gun barrel; this operation moves the slide, D, slightly and starts the cartridge shell. Should this prove insufficient the rifle barrel is drawn out far enough to admit of raising the lever, E, which operation moves the slide, D, and ejects the shell. An attachment of this kind must prove a valuable acquisition for the sportsman.

THE GREAT CRAB-SPIDER.

The great crab-spider belongs to the typical genus of this family, and is one of the formidable Arachnida that are said to prey upon young birds and other small vertebrates, instead of limiting themselves to the insects and similar beings which constitute the food of the generality of the spider race. All spiders are carnivorous, the dimensions of their prey varying with those of the destroyer, and it is by no means an illogical supposition that a spider whose spread of limb equals that of a human hand, might suck the juices of some of the smaller and more helpless vertebrates.

In Madame Merian's well known work on the insects of Surinam, there is a careful and forcible sketch of one of these great spiders (*Mygale avicularia*) engaged in preying upon a humming-bird, which it seems to have taken out of its nest. She gives also a description of this spider, mentioning that it chiefly feeds upon ants, but that when they fail, it climbs the trees and catches the humming-birds. For a time this account was believed, and the spider received the specific name of *avicularia* in consequence of its bird-catching propensities. After a while, however, several persons ventured to discredit the story, and at last both the account and the illustration were set down as simple fabrications of the imagination. Experiments were also tried, dead humming-birds being put into the dens of these spiders, without any result, and the whole of Madame Merian's account was bodily denounced as fabulous.

Lately, however, the *Mygale* has been seen repeatedly to kill the young, not only of the humming-bird, but of other vertebrates, and thus Madame Merian's reputation for veracity remains intact.

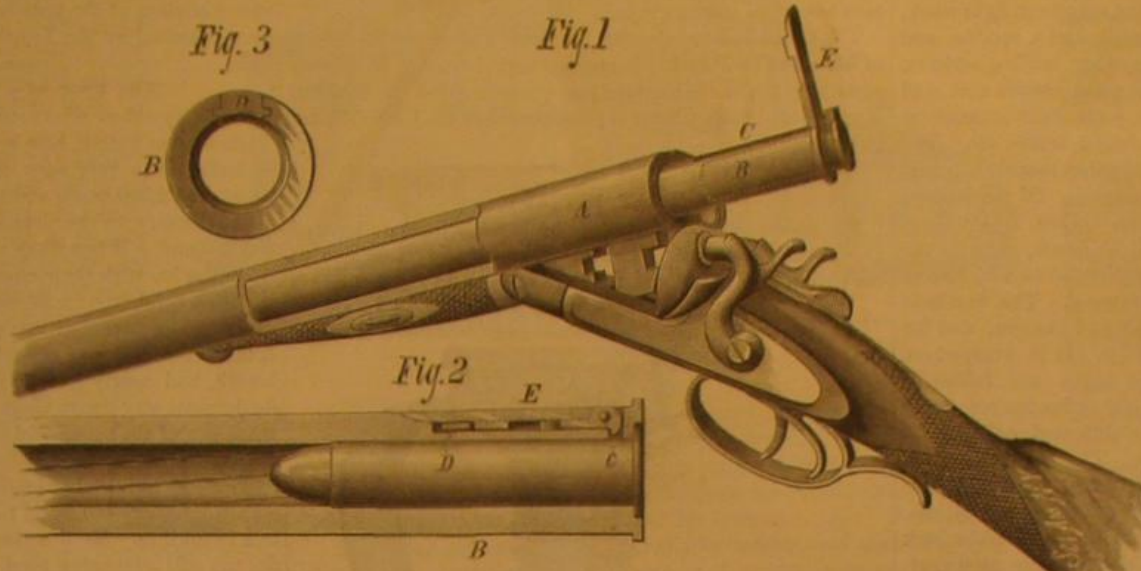
The *Mygale* spins no web to serve it as a dwelling. It burrows and lies in ambush in the clefts of hollow ravines, in volcanic tufas, or in decomposed lava. It often travels to a considerable distance, and conceals itself under leaves to surprise its prey, or it climbs on the branches of trees to surprise the colibris (i. e., humming birds) and the *certhia flaveola* (a bird allied to our common tree creeper). It usually takes advantage of the night to attack enemies, and it is commonly on its return toward its burrows that one may meet it in the morning and catch it, when the dew, with which the plants are charged, slackens its walk.

The muscular force of the *Mygale* is very great, and it is particularly difficult to make it let go the objects which it has

seized, even when their surface affords no purchase, either to the hooks with which its tarsi are armed, or to the claws which it employs to kill the birds and the anolis (a kind of tree lizard). The obstinacy and bitterness which it exhibits in combat cease only with its life. Some, pierced twenty times in the corselet, continued to assail their adversaries without showing a desire to escape.—Wood's Natural History.

The Peanut Crop.

The following facts gathered by a Virginia peanut dealer, and submitted by him to the *Commercial Bulletin*, show the peanut crop to be of much greater importance than most



STEVENS' RIFLE BARREL FOR BREECH-LOADING SHOT GUNS.

people imagine. During the past five years the Virginia crop has ranged between 225,000 bushels and 780,000 bushels. The lowest crop of Tennessee was 175,000 bushels; the highest, 305,000 bushels. Of North Carolina, the lowest crop was 60,000 bushels; the highest, 125,000 bushels. The largest crop of the whole country was that of 1876-77, amounting to 1,405,000 bushels. The estimated crop of the coming season is 1,290,000 bushels. The Virginia nuts are the largest and have the finest flavor.

The grades of the Virginia nuts are, respectively, common, prime, strictly prime or choice, and fancy. The prices for nuts during the present season, on a basis of prime to strictly prime, have ranged as follows: October 7, first sale, new crop, at \$1.25; and during the rest of the month at

Where it is found in sufficient quantities to be employed for works underground, such as water pipes, pumps, etc., the yew will last longer than any other wood. Gate posts and stakes of yew are admirable to wear, and in France the wood makes the strongest of all wooden axletrees. Of the beech are made planes, screws, wooden shovels; and common fowling pieces and muskets are also stocked with it, and beech staves for herring barrels are not unknown. The sweet or Spanish chestnut furnishes gate and other posts, railing, and barrel staves, hop poles, and other such matters, such as strong and good charcoal, though scarcely equal to that of oak for domestic purposes, but considered superior to that of any other for forges.

Hornbeam is the best wood that can be used for cogs of wheels, excelling either the crab or the yew; but its application in this manner is about at an end. As a fuel it stands in the highest rank, emitting much heat, burning long, and with a bright clear flame. In charcoal it is highly prized, not only for culinary purposes and the forge, but also for the manufacture of gunpowder, into which, on the Continent, it enters in large proportion.

In Russia, many of the roads are formed of the trunks of the Scotch pine, trees from six inches to a foot in diameter at the larger end being selected for the purpose. These are laid down side by side across the intended road, the thick of one alternately with the narrow end of the other, and the branches being left at the end to form a sort of hedge on each side of the road. When thus laid, the hollows are filled up with earth, and the road is finished, being analogous to the corduroy roads of North America. In Germany casks are made of larch, which is almost indestructible, and they allow of no evaporation of the spirituous particles of the wine contained in them. In Switzerland it is much used for vine props, which are never taken up, and which see crop after crop of vines spring up, bear their fruit, and perish at their feet without showing symptoms of decay. The un-

injured state in which it remains when buried in the earth or immersed in water renders it an excellent material for water pipes, to which purpose it is largely applied in many parts of France. The butternut is esteemed for the posts and rails of rural fences in America, for troughs for the use of cattle, for corn shovels and wooden dishes. Shellbark hickory provides baskets, whip handles, and the backbones of Windsor chairs. The pignut hickory is preferred to any other for axletrees and ax handles. The sugar maple is used by wheelwrights for axletrees and spokes, and for lining the runners of common sleds. Dogwood is used for the handles of light tools, such as mallets, small vises, etc. In the country it furnishes harrow teeth to the American farmer, and supplies the harness of horses' collars, etc.; also lining for the runners of sledges. The mountain laurel



CRAB-SPIDER, OR MATOUTOU.

\$1.20 to \$1.10. November—Sales during month at \$1.05, \$1.85 and 80 cents. December—80 and 85 cents. January—75, 80, and 85 cents. February—85 and 80 cents. March—80, 82½, 85, 90, 92½, and 95 cents.

Important and Excellent Appointments.

The appointment of Clarence King to the Directorship of the Consolidated National Surveys was confirmed by the Senate April '3. The same day the Senate confirmed the appointment of Dr. John B. Hamilton as Surgeon-General of the Marine Hospital Service.

A few days earlier Professor Francis A. Walker was appointed Superintendent of the coming Census.

It is doubtful if these offices could have been otherwise filled so wisely and acceptably.

is selected for the handles of light tools, for small screws, boxes, etc. It most resembles boxwood, and is most proper to supply its place. Bowls and trays are made of red birch, and when saplings of hickory or white oak are not to be found, hoops, particularly those of rice casks, are made of the young stocks and of branches not exceeding one inch in diameter. Its twigs are exclusively chosen for the brooms with which the streets and courtyards are swept. The twigs of the other species of birch, being less supple and more brittle, are not proper for this use. Shoe lasts are made from birch, but they are less esteemed than those of beech. Immense quantities of wooden shoes are made in France from the wood of the common European alder, which are seasoned by fire before they are sold. The wood of the locust is substituted for box by the turners in many species of light work, such as saltcellars, sugar bowls, candlesticks, spoons, and forks for salads, boxes, and many other trifling objects, which are carefully wrought into pleasant shapes and sold at low prices. The olive is used to form light ornamental articles, such as dressing cases, tobacco boxes, etc. The wood of the roots, which is more agreeably marbled, is preferred, and for inlaying it is invaluable. Of persimmon turners make large screws, and tinmen mallets. Also shoe-makers' lasts are made of it equal to beech, and for the shaft of chaises it has been found preferable to ash, and to every species of wood except lancewood. The common European elm is used for the carriages of cannon, and for the gunwale, the blocks, etc., of ships. It is everywhere preferred by wheelwrights, for the naves and felloes of wheels, and for other objects. White cedar serves many subsidiary purposes. From it are fabricated pails, wash-tubs, and churns of different forms. The ware is cheap, light, and neatly made, and instead of becoming dull, like that of other wood, it grows whiter and smoother by use. The hoops are made of young cedars stripped of the bark and split into two parts. The wood also supplies good charcoal. The red cedar furnishes staves, stopcocks, stakes, and is also used for coffins.

A few special applications of wood in this country are mentioned, separated into trades, namely:

Sieves, usually of black or water ash for the bottom and oak or hickory for the circle; whipstocks, white oak; baskets, willow, white oak, and shellbark hickory; picture frames, white pine and sweet gum; saddletrees, red maple and sugar maple; screws of bookbinders' presses, hickory and dogwood; hatters' blocks, sour gum; corn shovels, butternut; shoe lasts, beech, and black or yellow birch.

To attempt any comprehensive review of the list of American applications would require another column or more.

Reports on the Paris Exhibition.

Governor McCormick, Commissioner General to the Paris Exhibition, requested the Assistant Commissioners to complete and forward to him their reports by the 1st of April. The following is a list of these reports:

Governor R. C. McCormick, Commissioner-General: "The Administrative Bureaus of the American Representation at the Paris Exhibition of 1878."

F. A. P. Barnard, of New York, President of Columbia College, Assistant Commissioner-General: "The Exhibition at Large and the General Results thereof."

Daniel J. Morrell, of Pennsylvania, President of the Cambria Iron Works and President of the American Iron and Steel Association: "Iron and Steel."

Donald G. Mitchell (Ike Marvel), of Connecticut: "Household Furniture and Accessories."

William W. Story, of Massachusetts: "Art."

Henry Howard, of Rhode Island: "Textile Fabrics."

William T. Porter, of Delaware, artisan expert: "Machinery."

Thomas B. Ferguson, of Maryland, Commissioner of Fish and Fisheries: "Fish and Fisheries."

William A. Anderson, of Virginia, of the Tredgar Iron Works: "Transportation."

George W. Campbell, of Ohio, grape grower: "Horticulture."

John J. Woodman, of Michigan, President of the Michigan Grangers' Association, and practical farmer: "Grains."

A. J. Sweeny, of West Virginia, Mayor of Wheeling, artisan expert: "The Latest Devices in Machinery."

Samuel Dyshart, of Illinois, stock raiser: "Live Stock."

Thomas E. Jenkins, of Kentucky, Professor of Chemistry: "Chemicals."

Floyd B. Baker, of Kansas, Editor of the *Topeka Commonwealth*: "Forestry."

James D. Hague, of California, mining engineer: "Mines and Mining."

Pierce M. B. Young, of Georgia, planter: "Cotton."

Aristides Gerard, of Louisiana, inventor: "Steam Engines."

Joshua Q. Chamberlain, of Maine, President of Bowdoin College, and ex-Governor of Maine: "Education."

Eliot C. Jewett, of Missouri, mining engineer: "Technical Schools."

The following named reports have been requested from Honorary Commissioners appointed by the President on the nomination of the Governors of States:

William P. Blake, of Connecticut, Editor of the Reports of the Representation of the United States at the Paris Exhibition of 1867, Commissioner of the United States at the Vienna Exposition in 1873, and Commissioner to the Centennial Exposition at Philadelphia: "Ceramics."

Edward H. Knight, of the District of Columbia, Editor

of the "Mechanical Dictionary," "Agricultural Implements."

The reports are carefully collated and indexed by the Commissioner General and will be delivered to the Government by May 1. They will fill four volumes royal octavo, uniform with the reports on the Paris Exhibition of 1867 and Vienna of 1873.

It is to be hoped that the printing of these reports will not be long delayed. The industrial world moves rapidly, and such reports soon become practically antiquated.

The Commissioner-General has learned from the Director-General of the Exhibition that in spite of delays in the execution of the medals, he may expect the medals at an early date. As soon as received they will be forwarded to those to whom they were awarded.

The Commissioner-General expects to close up the affairs of his office by July 1. It appears that there will be a handsome sum to the credit of the Government out of the \$190,000 appropriated for a proper representation of the United States at Paris.

GRAY POTTERY.

The composition of that class of potter's ware designated as "gray" pottery was known thousands of years ago to the Chinese and Japanese. At the Louvre, in Paris, there is



GERMAN GRAY POTTERY.

to be seen a large vase of Japanese origin, several feet high, and of great beauty. In Europe gray pottery was first manufactured in Germany, in the provinces of Saxony, Bohemia, and Silesia, at the beginning of the Renaissance Period. Later, Boettcher manufactured gray pottery at Meissen, previous to discovering the art of making porcelain.

Our engraving represents a vessel, probably used to hold water or wine, of Silesian origin. It shows elaborate ornaments of different colors, in relief, on a sky-blue ground. It is now at the Louvre Museum, and illustrates well the artistic taste of that period.

NEW AGRICULTURAL INVENTIONS.

An improved seed planter, having a rotating hopper, which rolls on the ground, and in which there are a number of seed pockets, which deposit seed in a furrow formed by a plow or furrow opener, has been patented by Mr. William J. Ellis, of Oakland, Ga.

Mr. John Clayton, of the Grange Farm, Clayton (Brainerd P. O.), Minn., has invented an improvement in gang plows, the object of which is to regulate the width of the cut or furrow of the plow, so as to suit the power of the different teams that may be used, and to accommodate it to soil in which it is used. The plow is also provided with an adjustment for varying the depth of the furrow.

An improved rotary plow colter, which is provided with means for excluding dust and dirt from its bearing, has been patented by Mr. John Clayton, of Brainerd, Minn.

An improved cutter for plows, which is designed to shield the mould board, and lessen the wear of the plow, has been patented by Mr. Charles W. Twigg, of Fincastle, Ind. It

consists of a cutter applied at the junction of the land side and mould board and extending to the beam.

Mr. Patrick Groom, of St. Louis, Mo., has patented an improved handle socket for shovels, spades, and scoops, which consists in making the shovel strap separate from the shovel blade, and securing it by rivets in a countersink formed in the blade.

A novel churn, that agitates and aerates the cream by centrifugal force, has been patented by Messrs. E. B. Older and F. E. R. Megow, of Independence, Iowa. This invention consists in a concave rotary dasher and a corrugated gatherer rotated by the dasher shaft.

A hay rack and fence, which is constructed so that the fence may be supplied with additional bars or rails, to convert a portion of the panels into feeding racks for cattle, has been patented by Mr. Louis Prince, of Nashville, O.

The Fate of a Herd of Buffaloes.

An army officer who recently arrived in Chicago from the Yellowstone Valley, tells a story of what happened to a herd of buffaloes as they were migrating southward. The herd numbered 2,500 head, and had been driven out of the Milk River country by the Indian hunters belonging to Sitting Bull's band. When they reached the river they ventured upon the ice with their customary confidence, coming upon it with a solid front, and beginning the crossing with closed ranks. The stream at this point was very deep. When the front file, which was stretched out a quarter of a mile in length, had nearly gained the opposite shore, the ice suddenly gave way under them. Some trappers who were eye-witnesses of the scene said it seemed as if a trench had been opened in the ice the whole length of the column. Some four or five hundred animals tumbled into the opening all in a heap. Others fell in on top of them and sank out of sight in a twinkling. By this time the rotten ice was breaking under the still advancing herd. The trappers say that in less than a minute the whole body of buffaloes had been precipitated into the river. They were wedged in so thickly that they could do nothing but struggle for a second and then disappear beneath the cakes of ice of the swift current. Not a beast in all that mighty herd tried to escape, but in a solid phalanx they marched to their fatal bath in the "Big Muddy." In a minute from the time the first ice broke not a buffalo's head or tail was to be seen.

Possibly occurrences of this sort, in ancient tertiary times, helped to form the remarkable deposits of bones found in the old lake beds of the great West and elsewhere. In these deposits the earth is literally crowded with the bones, sometimes chiefly of one type, sometimes comprising many distinct species. In the latter case the victims were probably swept away by sudden floods, their remains mingling confusedly in quiet basins.

The Textile Industries of Finland.

It is reported by the German press that a large amount of spinning and weaving machinery is being transferred to Russia from German mills, closed on account of declining trade. The Grand Duchy of Finland is becoming one of the principal seats of Russian textile manufactures.

There are five large cotton mills at Tammerfors, Abo, Nikolaistad, Forssa, and Kirooskoski. The imports of raw cotton have nearly trebled since 1866. The spinning mill of Forssa has 18,000 spindles and 500 looms, and employs 1,500 hands. The mill at Abo manufactures thread only, and Kirooskoski only textiles. Mostly all the domestic weaving of linens has been superseded by the great linen mill of Tammerfors, the only one in the country. It has five turbines, and employs about 900 hands. There are six manufactories of cloth, one of knit goods, and five mills for the manufacture of woolen yarns and textiles. The largest woolen cloth factory is near Abo, and turns out about 65,000 or 70,000 yards of cloth. The proximity of the Southern provinces to cotton supplies from Egypt will, of course, give them an advantage over such distant provinces as Finland.

Curiosities of Bismarck's Brain.

In Dr. Busch's "Book on Bismarck," the Prince describes a horse accident he once had when riding home with his brother. He fell violently on his head. "I lost consciousness," he says, "and when I recovered it I had only half. That is, one part of my intellect was clear and good, the other half had gone." Finding (on examination) his saddle broken, he called for his groom's horse and rode home. When the dogs there barked, by way of salutation, he thought them strange dogs, and scolded them angrily as such. Then he said the groom had fallen with the horse, and they should go and fetch him, and he became angry when they would not do that (because of a sign from his brother). He seemed to be himself and at the same time the groom. After eating and sleeping he was all right next morning. He points out that he had done all that was necessary in a practical respect; herein the fall had caused no confusion of ideas. "In short, it was a remarkable illustration of the fact that the brain lodges different mental powers; but one of these had been stupefied for some longer period of time by the overthrow."

THE AFRICAN CABLE.—The steamer Kangaroo, with part of the cable to be laid between Natal and Aden, left the Thames April 7 for Natal via the Suez Canal. The Natal and Zanzibar section will be open for business in July. This will place South Africa within a week's communication of London. The remainder of the line will be completed before the end of the present year.

OLD HOMES MADE NEW.

It is sometimes very desirable that an old house should be made over. But very often such remodeling costs as much as an entirely new structure; sometimes it costs more. The reason of this is doubtless that the alterations are made without sufficient forethought; they are made as they suggest themselves one after another. And when all is done it is an old house after all; the alterations do not seem worth what has been expended to effect them, and the owner is disgusted. More careful planning would have prevented mistakes, produced better results, and lessened the cost.

We have before us a book* designed to aid any who wish to make an old home into a new, which, as it helps to disseminate true ideas, is welcome. By the courtesy of the publishers we present the illustrations of the present article.

The author of this book says very justly that whether a dwelling should be remodeled or not is often an open question. It should not be done unless the building, in its construction and material, is of such a solid and substantial character as to render its destruction unadvisable; or unless its preservation is highly desirable, owing to family associations, its peculiar style of architecture, or some historical interest. The convenience of the plan, its adaptation to the individual wants of those who are to occupy the house, should be the paramount consideration. Let the exterior grow naturally from the plan. Let architectural effect be obtained by the natural combinations of the constructive portions of the work. Let the most effective result possible be secured at the least expenditure of labor and detail in design.

In our judgment the author has been generally very successful in these projected alterations. The illustration we present is, perhaps, one of the least striking, and yet any one can see in a moment by comparing these houses how much good taste can do in making a moderate outlay of money produce excellent results.

The house in question was, as is seen, simply a commonplace building. It was in excellent condition as regards its materials, and large, airy rooms with open fireplaces, and a generous hall. The wish was to improve its appearance without destroying the date and character of the building. A veranda was added on one side; a projection on the first floor gave a bay window, continued in square form above, and breaking the roof with a gable. Portions of the end gables were made to project, forming canopies over balconies from the attic floor. A new porch was added on the front, and new sashes with one light of glass were introduced in the lower part of the windows. These simple, inexpensive changes interfered but little with existing work. The other illustration is of a remodeled hall. In the original house the stairway was narrow and inclosed. The desire was to make a hall that should be an attractive apartment, as well as a passage way. The old staircase was removed and a new one in hard wood built. A fireplace and settle were introduced at the foot of the stairs. The upper portion of the fireplace has the brickwork exposed, while the lower portion is incased for mirrors, etc. Curtains are substituted for doors. The end of the main hallway is marked and divided from the staircase by a newel column, finished with brackets. The whole makes a picturesque and comfortable apartment, a vast improvement on the "entry," which is really all that our halls usually are.

We need add only that the book is useful as a suggestion for plans and designs for building new as well as remodeling old houses.

A Possible Cause of Unexplained Fires.

In a discussion of obscure causes of spontaneous combustion, by the French Academy of Sciences, a short time since, M. Cosson said that only a few days before, while he was at work in his laboratory, a portion of the boarding of the floor took fire. The fire began in the vicinity of an air-hole, fed with warm air from a stove four meters away, on the floor below. A similar accident took place two years ago, and in consequence M. Cosson had the boards adjoining the air-hole replaced by a slab of marble. The boards which now ignited adjoined the marble. The heat to which the boards were subjected was, however, very moderate, being only that of warm air at 77° Fah. Nevertheless, M. Cosson said the wood had undoubtedly been slowly carbonized. Being thus rendered extremely

porous, a rapid absorption of the atmosphere had resulted, and sufficient caloric was thereupon produced to originate combustion. The danger thus disclosed, said M. Cosson, is one to which the attention of builders ought to be directed. In the instance in question, M. Cosson was able to extinguish the fire with a little water, as he was present and witnessed its beginning; but had it occurred at night, during his ab-

M. Dumas also cited a singular occurrence in the studio of a painter, which he had witnessed. The artist had taken some cotton wool to wipe a picture. He rubbed the oily surface of the painting for some time with the porous material, and then flung it from him; the cotton spontaneously ignited during its passage through the air. It is well to remember, concluded M. Dumas, that extremely porous or minutely divided matter, conducting air, is capable of instantly producing a very elevated temperature.



VIEW BEFORE ALTERATION.



VIEW AFTER ALTERATION.

verized charcoal will often take fire spontaneously. It is for this reason that it is usually pulverized with sulphur, which robs it of the property in question. Wood deprived of its moisture by the action of warmth, continued for a long time, is transformed into a substance analogous to lignite or turf. Its particles experience a species of pulverization, or minute division, which brings it into essentially the same condition as that of crushed charcoal. In this state it condenses the air and takes fire. M. Dumas said that he had known a case

two at a time. These boxes are easily and neatly stacked, the labels are fixed once for all, and to open one and show its contents, or take some out and reclose the box is the work of a moment. This question is one of much greater importance than at first sight appears. Folding up and retyping parcels is irksome and exceedingly uninteresting work, and is such as is not done very quickly at any time. Piles of packages which have been taken down to show customers, collect on the counters to be done up "presently," because they cannot be done up while the customer is being served.

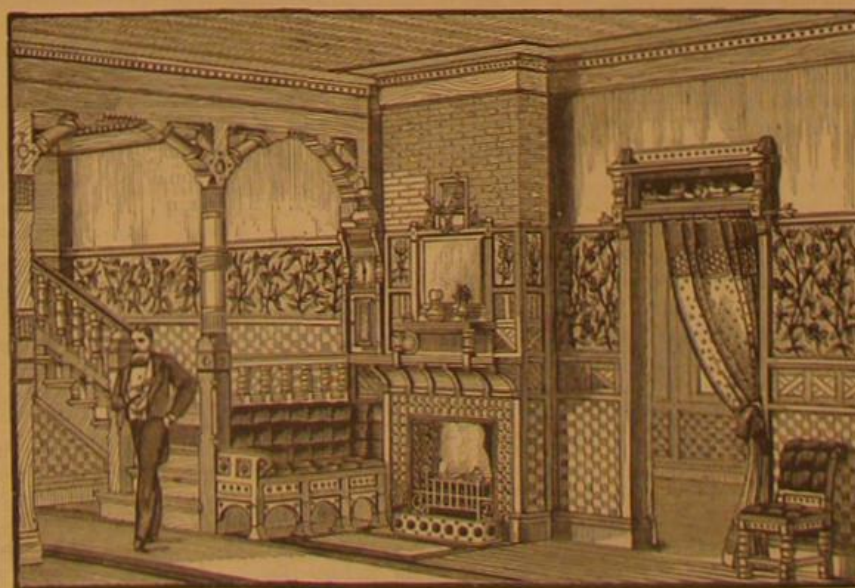
These have to be done up, and some one must do it. Here is an important saving. One London ironmonger, whose sales in furnishing ironmongery, in a moderate sized shop, consist of about one half American articles, recently assured us that he had, from the saving of labor in this way, been able to dispense with about one fourth the assistance he would otherwise have required for the increased business done in small articles."

The Nevada Paint Mine.

The paint mine at Reno, Nevada, comprises a ledge 42 feet wide and of unknown depth. The material is said to mix well with oil, and not to settle on standing. The mineral contains a small quantity of silver and traces of gold.

American Flour in Turkey.

Mr. Heap, the United States Consul General at Constantinople, advises the Department of State that a demand for American flour will probably arise during the year in Turkey. As a large proportion of the flour imported will be for transportation on animals into the interior, he advises that it be put up in strong sacks. Most of the flour brought from Russia is in sacks or bags holding fifty or one hundred pounds each.



A REMODELED HALL.

where a beam in a cart shed had taken fire in this way. Formerly, in the theaters, the lamp boxes, filled with refuse, frequently ignited spontaneously in this manner. The oily dust and debris condensed the oxygen of the air. In works where Adrianople red is applied to cotton, impregnated with fatty matter, spontaneous combustion frequently occurs.

* "Old Homes Made New." With Explanatory Text. By William M. Woollett. New York: A. J. Bicknell & Co.

Leadville—The Place.

This infant city of the past year, with its closely built streets, its bustle of trade, its throng of teams that fill and block the way, and its surging masses of humanity that move in ceaseless currents from daylight until the midnight hour, is one of the marvels of the age. The site is favorable—a smooth plateau, sloping gently to the west, rounding off into California gulch on the south, and rising to a slight ridge on the north. When the town began, the plat was covered with pine trees, but nearly all have fallen, and each day diminishes the few that ought to be carefully preserved. Fortunately, thick forests surround it on all sides, and most of the timber is green, furnishing excellent building material at the lowest possible cost. Building is going forward faster now than ever before, and the town spreads visibly day by day. Along all the roads leading out north and east, strings of foundations, half built or completed cabins, stretch continuously for a distance varying from half a mile to two miles. On the other sides they do not reach so far. There are hundreds, perhaps thousands, of these squatter claims, and it is nothing unusual to hear of their sale for \$50, \$100, or \$200 each, when the improvement is nothing more than four logs, poles, or slabs.

The altitude is about 10,400 feet above the sea, and the outlook is grand and magnificent. To the east, beyond the swelling green of the fine forests, are the shining peaks of the Park range. Northward are lofty summits that close in the head of the valley of the Arkansas. Westward across the wide level valley, are those stupendous masses, Massive mountain, Mount Elbert, La Plata mountain, and all the magnificent Sawatch range, here the mother mountains. Southward the view is down the valley of the river—a vanishing vista, shut in by mountain walls.

The characteristics are those of any prosperous mining camp, but on a marvelous scale. There is an air of permanence not common to such, but otherwise the history of its growth has been a hundred times repeated in California, Nevada, and the Rocky Mountain States and Territories. Life is intensified. Everybody who has anything to do is on the jump. The rasp of the saw and tattoo of the hammer are heard from daylight to dark seven days in the week. Business occupies the same time and reaches far into the night as well. You must elbow and push your way through the crowds that fill the sidewalks, and wait for an opening in the teams and vehicles that throng the streets to cross from one side to another. Rents are fabulous. Real estate has advanced a thousand per cent in three or four months. Such is Leadville at a glance.—*Denver News.*

Spontaneous Combustion.

There was an interesting discussion on this subject at a recent meeting of the French Académie des Sciences. M. Cosson described an accident which had occurred in his laboratory a few days before. While the narrator was working in the laboratory, a portion of the boarding of the floor spontaneously took fire. The boards were in the vicinity of an air hole, fed with warm air from a stove four meters away on the floor below. A similar accident took place two years ago, and in consequence M. Cosson had the boards adjoining the air hole replaced by a slab of marble. The heat to which the boards were subjected was, however, very moderate, being only that of warm air at 25° C. Nevertheless, M. Cosson said the wood had undoubtedly been slowly carbonized. Being thus rendered extremely porous, a rapid absorption of the oxygen of the atmosphere had resulted, and sufficient caloric was thereupon produced to originate combustion. The danger thus disclosed, said M. Cosson, is one to which the attention of builders ought to be directed. In the instance in question, M. Cosson was able to extinguish the fire with a little water, as he was present and witnessed its beginning; but had it occurred at night, during his absence, it would undoubtedly have completed its work of destruction. M. Faye stated that at Passy, a few days before, a similar case of spontaneous fire, due to the action of the warmth from the air hole of a stove upon the wood work, had occurred at the house of one of his friends.—*Manchester (Eng.) Cotton.*

Mildew in Cotton Goods.

The different varieties of mildew that attack cotton goods belong to the fungoid class of plants—a division, perhaps, more numerous than any other section of the vegetable world. They propagate themselves by spores or seeds, which are generally diffused from bursting cells. These are carried—invisibly to the naked eye—upon every breeze in all directions, being deposited upon and in everything with which they come into contact. Few, probably, of the millions thus borne by the winds find fit habitats for development, and consequently perish in a short time. Too little is known of them to state with any degree of correctness the duration of the vitality of these germs. Doubtless it will be longer or shorter, accordingly as the circumstances in which they are deposited are favorable or otherwise. The plants, however, are purely parasites, finding their chief habitat upon organic substances, either vegetable or animal. And they are not particular whether these be living or dead—at least both living and dead organisms are subject to attack by the same or different species. They have cellular or filamentous bodies, and are concentric in their method of development. When full grown they are rarely uniform in shape. Contrary to nearly every other kind of vegetable life, they absorb oxygen and exhale carbonic acid. This

causes the disagreeable odor always experienced in the presence of mildew. These parasites, in several of their numerous species, are found in cotton plantations, and in all probability the species peculiar to the plant is one of those with which merchants are too familiar. It is not unlikely that the spores, or seeds, are brought over in abundance with the raw cotton to this country, lying dormant until favoring circumstances stimulate their development. The germs are so minute that they can with ease run the gauntlet of all processes cotton undergoes in its transformation into cloth. It may be objected that these insignificant atoms of life could never preserve their vitality when passing along with cotton in the form of yarn through a trough of boiling size. This may safely be granted; but we do not size our wefts, and it is with the latter that it may be carried into a habitat fitted for its future growth. This view receives a considerable amount of confirmation from the fact that mildew most frequently takes place in goods in transit to India and China; otherwise expressed—when these germs are carried through latitudes identical with those of their native fields. Surrounded with every requisite condition—embedded in a mass of vegetable fiber, composed of interlaced threads the interstices of which contain a sufficient supply of oxygen in the atmosphere filling them; a large quantity of moisture, taken up by the natural absorbent power of cotton from our humid atmosphere, or otherwise introduced; closely packed in an air-tight covering, and subjected for weeks to the stifling heat of a ship's hold in its passage through tropical oceans—sure, if there be a living germ of mildew in a ship's cargo of gray cloth, here are forces sufficient to render its development assured.—*Textile Manufacturer.*

What Came of one Hive of Bees.

In a memorial to Congress relative to the coming census of the United States, the superintendent of the census of 1860, Mr. Kennedy, gives the following statistics as an illustration of the stupendous results from a single hive of bees, transported to the Pacific coast less than thirty years ago. From the single county of San Diego, California, in 1876, there was shipped the astonishing figure of 1,250,000 lbs. In 1877 there were in that county 23,000 colonies of bees, and in one day, September 6, 1878, there were shipped from that port 78 barrels, 1,053 cases and 18 tons; and that from and including July 17 to November 10, 1878, less than four months, that one county exported over 1,000 barrels, 14,544 cases, and nearly 20 tons. He who would strike out (from the census report) the item of honey, could not have known, so great has the interest in this product become, that many people in California have from 500 to 1,000 hives, and that over 100 people in one county have each more than 100 colonies of bees. According to the *London News* of January 18, there arrived in November, at Liverpool, 80 tons of honey, the product of the bees of one individual; and that a Mr. Hodge, in the first week of January last, landed 100 tons at a London wharf, the product of California. The annual product of honey has grown to 35,000,000 lbs. annually.

Westward Progress of the Imported Cabbage Worm.

In 1869, in my second report, in treating of this insect, I remarked, "There is every reason to fear that it may some day get a foothold in our midst," after showing that it was then confined to certain restricted parts of Canada and New England, and had not spread west of New York. It has been making further progress westward every season since. The past year it has done considerable damage as far west as Chicago, and I have also received good testimony that it was observed around St. Louis. I have given my reasons in the report referred to for believing that it will prove much more disastrous to the cabbage fields around St. Louis than the southern cabbage worm (*Pieris protodice*), which has always been with us, and has done, at times, considerable damage; and I refer those who wish to be prepared with a full knowledge of the habits of this species, to the same report.

As remedies, few liquids will prove more effectual than hot water, judiciously applied, though 1 lb. of whale oil soap, dissolved in about 6 gallons of water, or even a strong tar water, may be used to advantage. The application should be made several times during the year, as it will be most effectual when the worms are young.

As preventive measures, the worms may be induced to transform under flat pieces of board laid upon any object that will raise them about an inch from the surface of the ground. These boards should be examined every week and the transforming larvae or the chrysalids destroyed. The butterflies may also be captured by hand nets and prevented from laying their eggs.—*Professor C. V. Riley, before the Mo. State Horticultural Society.*

Borers in Apple Trees.

Now is a good time, says a writer in the *Rural Sun*, to cut out these pests where they have not been attended to.

A few days ago I went over an orchard that has fallen into my hands, and in one day's work think many valuable trees have been saved. As many as five full grown borers were cut out of one tree five inches in diameter. In some instances these were found running up the trunk six inches, and not over an inch apart parallel. It takes very close searching sometimes to find them. Sometimes a thin wire can be used with good effect, when the knife and chisel can hardly reach them. In quite a number of instances I found that the spotted woodpecker had done the work for me.

They seem to know just where to find them when above ground, and rarely fail to bring them out. They need not peck a large place at all times, as their hard pointed, barbed tongue can be inserted and haul them out. It should be a rule among all to let these useful birds live undisturbed. They are tame, and boys are prone to stone them, or, when beginning to shoot, practice on these poor fellows.

When a tree is completely girdled by the borer or mice, it can often be saved by taking twigs of last year's growth, cutting wedge shape at both ends, and inserting in the bark below and above the injury, thus conveying the sap through them. Thus have we saved many a valuable tree that would otherwise not have survived the summer. After cutting out the borers fill up with earth over the wounds, and they will heal up if not too severe.

Flowers in Winter.

With but little trouble, says a correspondent of the *Country Gentleman*, any person can keep up a constant succession of beautiful flowers in the house from the holidays until the season of their blooming in the yard or garden. To do this, cut some small twigs of the various flowering shrubs or trees growing in the yard or lawn, and put them in bottles or jars containing pure water. If the weather is very cold when the twigs are cut, care must be taken not to injure the buds, which is very easily done when they are frozen. After the twigs are cut lay them in a cool room a few hours, then put them in the bottles of water, and let them remain two days in a cool place where the water will not freeze, after which they should be brought to the heat gradually. They will bloom if brought to the warmth when first cut, but the flowers and foliage are not so strong and luxuriant. After bringing them to the warmth the bottles should be filled up with fresh water every day.

When treated in this way, all the following named shrubs bloom nicely: *Daphne mezereum*, *Forsythia*, *Spiraea prunifolia*, *Deutzia gracilis*, *Lilac* (white and purple), *Pyrus japonica*, *Syringa*, *Wiegela*, and many others. The twigs of the *Cercis canadensis* (Judas tree, sometimes called Red Bud, which grows very abundantly in many places in our woodlands), when thus treated give a great profusion of beautiful red and purplish pink flowers, and are exceedingly beautiful.

I use hyacinth bottles, the tall ones of different colors. Beginning early in the winter with the *Daphne* and the *Forsythia*, they being among the first bloomers of spring, I tie a few twigs together with a soft woolen string (if tied tight it stops the flow of the sap), put them into the bottles, and give them plenty of light and water, and in two or three weeks have a nice bunch of flowers, the red contrasting beautifully with the yellow. In about a week after starting the first I set a couple more bottles, and so on until the fine fine warm weather of spring produces them out on the lawn. The Japan quince does not produce flowers on the small twigs of the last year's growth, but the buds are formed on the two year old wood; hence care must be exercised in selecting from this shrub, or no flower buds will be obtained. I now have *Forsythia*, *Spiraea prunifolia*, *Lilac*, *Deutzia gracilis*, and *Daphne cneorum* in full bloom, making a beautiful display in the window.

The Trade in Birds.

A busy but quiet industry in this city is that of the bird fanciers. A dealer in canary birds says that last year he imported 100,000 birds, which were readily disposed of at fair prices. They are generally brought from the Hartz mountain region of Germany. From the large dealers a fine male canary, with a good voice, can be bought for \$3. Choice specimens, with extraordinary vocal powers, bring sometimes \$10. Female birds for breeding purposes sell for \$1. Next to the canary the mocking bird is most in demand. Those whose vocal powers are well developed are sold for \$25 and upward. The birds come from Virginia and other Southern States, and also from Mexico. The bullfinch is highly regarded when well trained. A good whistler is worth from \$25 to \$40. The goldfinch, chaffinch, nightingale, lark, and the linnets and thrushes are also prized as songsters. Of other birds not songsters, thirty different species, kept as pets for their beauty or acquirements, may be found in market. Of these the parrot is most in demand. A well trained bird, of either the gray African variety or the green American, is worth \$50, or even \$100. The most brilliantly colored birds are the Australian paroquets and strawberry finches.

Sod Fences.

A Louisiana paper says that Mr. Joseph Jefferson has been fencing his orange grove plantation in that State in a novel and effective way. He begins by erecting, for each side of his fence, sods three feet in width, divided into five layers, at an angle of 75°. The soil from beneath the sod exactly fills the space between the erected sods, leaving a three foot ditch on each side. On the top of this sod-and-soil fence, which is four and a half feet at the base and three feet high, he plants cuttings of the Macartney rose, which are protected by a panel of boards. This fence, while within the reach of any man who will shoulder his spade and work, possesses the advantages of an impassable barrier, of permanence, of not needing repairs, of drainage, and of being a most beautiful ornament. Mr. Jefferson will soon have inclosed a section of his plantation containing 2,600 acres, and at one half the cost of a stake fence. It is thought that this most economical and useful fence will ultimately be generally adopted in the Southern States.

A Cupola works best with forced blast from a Bake Blower. Wilbraham Bros., 2318 Frankford Ave., Phila.

MENT referred to in these columns may be had at this office. Price 10 cents each.

(17) H. H. C. asks for the rule for finding the tonnage of a flat bottom boat. A. For carpenter's tonnage multiply together length, breadth, and depth in feet, and divide by 95.

(30) G. A. H. asks: Which will create the better draught, a seven inch pipe over a six inch flue or a six inch pipe over the same flue? A. Difference ordinarily in favor of the 7 inch pipe.

office. Price 10 cents each.

(31) P. J. writes: 1. At this place large quantities of sawdust, chips, and similar refuse from planing mills are being deposited in the shallow water at the shore here. What is going to become of this in time, and what are the sanitary effects of the material while the changes are going on? A. It depends much upon the nature of the soil or drift—if undisturbed it may ultimately pass into a variety of brown coal or lignite. Under the circumstances we think the slow process of change will not very materially affect the health of near residents. 2. Are any injurious effects to health likely to arise from accumulations of sawdust, shavings, etc., in a back yard exposed to the weather? A. Probably not, to any extent. It would, however, be advisable to remove it occasionally.

(32) J. A. L. asks: How are the marks of a boxwood rule put on, and how are they colored black? A. They are regularly printed from a steel die, which indents the wood and leaves the ink.

(33) J. D. C. asks for a rule for calculating the power of a double toggle joint press, the toggles being operated by a right and left hand screw passing through nuts in the middle joint of the toggle. A. By the principle of virtual velocities: the power applied to the handle of the wheel on the screw, multiplied by the travel of the handle in a (small) unit of time, the product divided by the movement of the platens in the same time; the result, less the friction of the machine, will give the pressure on platens in that particular position, but the power is constantly changing with the change in the angle of the links. This rule is not strictly accurate, but will answer practical purposes.

(34) "Squirrel" writes: A hunter discovers a squirrel upon the trunk of a tree. As he follows it around the tree the squirrel keeps on the opposite side of the tree. The hunter is supposed to go a greater distance in circling the tree than the squirrel. Does or does he not go around the squirrel in making a circle of the tree? A. He goes round the squirrel. (1) He goes round everything within the circle of his course, whether the included objects are at rest or in motion. It makes no difference whether the squirrel keeps the tree between himself and the hunter all the time, or part of the time, or none of the time, the hunter goes round him. 2. It is admitted that the hunter goes round the tree. If he does not also go round the squirrel on the tree, he must, at some stage of the journey, go between the squirrel and the tree, which is contrary to the conditions of the case.

(35) F. asks: 1. What instruments are used in making perspective drawings? A. The camera obscura, the camera lucida, and the perspective lineal. 2. And what is the best instrument for describing an ellipse? A. The trammel and the ellipseograph.

(36) W. S. G. asks if there is any cheap means of deodorizing carbon or ground oil. A. It cannot be completely deodorized, but the unpleasant odor may be nearly destroyed. Violently agitate it for some time with about three per cent of sulphuric acid, and after settling draw off from the scum and impurities; agitate for half an hour or more with clean water containing a few per cent of chloride of lime (calcium hypochlorite), settle, draw off, and agitate with weak aqueous carbonate of soda solution. Finally, agitate with powdered quicklime, and let it stand until it becomes perfectly clear.

(37) J. F. writes: A friend of mine says that the driving wheels of a locomotive should be made as light as possible, and that the best place to put the weight is in the boiler and frames. I say that the best place to put the weight is in the wheels, for then there is less required on the journals. Who is right? A. Your friend is right; weight placed below the springs is much more injurious to the rails than the same weight above the springs, hence, the wheels, axles, boxes, and eccentrics should be as light as consistent with their work.

(38) W. F. C. asks: 1. How long will a U magnet retain its power? A. If provided with an armature and not jarred or suddenly separated from its armature it will retain its magnetism indefinitely. 2. Where can I get a good magnet? I don't see anything of the kind advertised in your columns. A. Dealers in philosophical instruments keep them, and they may usually be purchased from dealers in general hardware. 3. What metal is most easily attracted by the magnet, or on what substance has the magnet the most power to attract or repel? A. Another magnet. 4. How can I make a powerful electro-magnet? A. By bending a bar of round iron into a U form and placing on each limb a bobbin of insulated copper wire. The power of a magnet depends on its size, upon the size of the battery in connection with which it is used, also upon the size of the wire used and the number of convolutions of the bobbins.

(39) R. C. writes: In a recent number of your valuable paper, I read a notice about observations made in England for ozone. Could you tell me where any regular observations are made in this country, and what method they use? A. Few systematic observations upon atmospheric ozone have been prosecuted, or, if carried on, have rarely been published. You will find an exhaustive article on this subject in No. 154 of the SCIENTIFIC AMERICAN SUPPLEMENT.

(40) H. S. H. asks: 1. What is Ohm's "law," or where can I find it? A. Ohm's law is as follows: The strength of the current is equal to the electro motive force divided by the resistance. You will find Ohm's law in almost any work on physics. 2. Which of the following batteries will do the most work at the least expense: Daniell, Grove, Carbon, or Leclanche? A. It depends much on the kind of work required. For open circuits the Leclanche is best; for closed circuits the Daniell is best. 3. Will it in any way affect the working of any of the above, to close them up water tight? A. Most batteries generate gas, which must have an escape. 4. Will the Leclanche battery be affected by any motion (say that of a small boat) that will cause the disturbance of the liquid included? A. We do not think that motion would seriously affect the working of the Leclanche battery.

(41) H. I. & Co. ask: When running a high pressure engine on 80 lbs. steam and exhausting into an

improved condenser, condensing with cold water at 60° temperature Fahr., how many times the volume of condensed steam will be required in cold water at 60° in order to procure 1 lb. vacuum? Also how much to procure 10 lbs. vacuum? A. Compute the temperature of the water of condensation by rule in Haswell's Pocket Book, page 577; from this temperature ascertain from a table of temperatures the back pressure, and deduct this from 14.7 lbs., the result will be the amount of vacuum obtained. Note that your 80 lbs. pressure is above the atmosphere, and its temperature is 333° Fahr.; the temperature due to 1 lb. vacuum is 307°, and that due to 10 lbs. vacuum 160° Fahr.

(42) B. M. A. asks if there is a flux that will make tinsmith's solder flow as freely on cast iron as it does on tin. A. A good flux for this purpose is made by putting zinc into muriatic acid until bubbling ceases.

(43) D. B. L. asks how the precious metals are separated from each other and from the base metals where carried on a large scale. A. Consult "Elements of Metallurgy," by J. A. Phillips, London, 1874.

(44) W. H. C. writes: I contemplate making a lightning rod by riveting strips of sheet copper together and nailing the same to my house, using proper points. Is there any danger of shingle being set fire by lightning passing down the same, or other objection to a rod constructed on the above plan? A. If the copper strip were of liberal size and the ground connections good it would be efficient.

(45) R. E. H. asks: 1. Will a steel spring give back as much force in the recoil as was spent in compressing it, and if not what is the waste? A. Yes, if not strained so as to effect a "set." 2. Will air if compressed and then allowed to expand give back as much force in the expansion as it received in the compression? A. Yes.

(46) W. S. writes: 1. We use plaster of Paris moulds for pottery and earthenware. What can be added to the plaster to improve it, as it soon pits and chips? A. Try a hot solution of alum and water glass. 2. What work will give me the most information on the different metals and clays used in the industrial arts as to their fusing points, manufacture, and cost? What is the best work on the analysis of clays, soils, etc.? A. You may consult Wagner's "Chemical Technology," Cook's report on New Jersey clays, and Caldwell's "Agricultural Analysis."

(47) C. B. F. asks: 1. What is the best and cheapest water motor for running a sewing machine on a low water pressure? A. Consult our advertising columns. 2. What will take linseed oil and putty stains out of a marble washstand? The above materials were used to cement water basin to the marble slab. A. Mix up a quantity of the strongest soap lyes with quicklime, to the consistency of milk, and lay it on the stone for twenty-four hours; clean it afterwards by using fine putty powder and water.

(48) J. M. H. asks: In a well eighty feet deep where should the cylinder be placed, at the top or at the bottom—depth of water 20 feet? A. Place the pump not more than 20 to 25 feet above surface of water.

(49) W. B. C. asks whether a liquid tight packing for piston has ever been discovered. If there has been such a packing used, what is it? A. The best liquid tight packing, is a cap packing of either leather or India rubber.

(50) M. F. L. asks at what point the exhaust should enter a tank, whether above or below the water line, and is it necessary that the egress opening should be larger than the ingress to the tank. A. If the exhaust is merely blown into the tank, above the water, the egress may be somewhat the smallest if you wish to use the water quite hot.

(51) P. F. S. writes: A is running an engine 14 inches diameter, and 24 inches stroke, with exhaust 2½ inches diameter. B is running an engine 16 inches diameter, and 24 inches stroke, with 3 inch diameter exhaust pipe. A contends that his exhaust is larger in proportion to his cylinder than B's. B contends that his exhaust is larger than A's, in proportion to the cylinder. Which is right? A. The proportion of exhaust in B's engine is the largest.

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

C. M. M.—It consists chiefly of quartz and orthoclase and talcose schist, with a small quantity of ferruginous matters. The rock probably contains a trace of silver. "Exeter."—It is mispickel or arsenical pyrites—arsenic 46.0, sulphur 19.6, iron 34.4—H. S.—The water contains much aluminum and iron sulphates. The styptic taste is due chiefly to the latter salt. It is not fit to drink. The brown precipitate is iron oxide.—J. M.—The orthoclase rock contains micaceous or specular hematite (iron sesquioxide) and ilmenite—titaniferous iron.—G. T. B.—We think your specimen is not meteoric iron.—W. C.—It is graphitic granite. Besides graphite (plumbago or blacklead) it contains much iron sulphide—pyrites—and hornblende.—G. L. R.—The vermillion contains much oxide of mercury, which probably reacts upon the oils used and upon the sulphide of mercury, forming a basic sulphate.

COMMUNICATIONS RECEIVED.

On a New Use for Petroleum. By J. S. M.
On the Siphon. By J. E. H.

English Patents Issued to Americans.

From March 18 to March 21, inclusive.

Axles, H. Watkeys, Syracuse, N. Y.
Candlestick, A. J. Smith et al., Ukiah City, Cal.
Clutch mechanism, T. W. Capen, Stamford, Conn.
Engine, hot air, H. W. Sherrill, Jersey City, N. J.
Gas checks for ordnance, B. B. Hotchkiss, N. Y.
Millstone driver, P. H. Childers, Waynesboro', Va.
Pumping machinery, E. J. Molers, San Francisco, Cal.
Railway switch, J. S. Riverton, N. J.
Screws, C. G. Dayton, Plymouth, Mass.
Sewing machines, G. McKay, Boston, Mass.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were

Granted in the Week Ending

March 18, 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.

Addressing machine, D. F. Bell	213,315
Ammoniacal gas, dry, F. M. McMillan	213,294
Annunciator, electric, L. Finger	213,282
Automatic press screw, E. M. Ivins	213,334
Axle lubricator, vehicle, J. M. Smith	213,461
Bag holder, D. & C. Garver (r)	8,625
Baling press, P. K. Dederick	213,280
Barrel and cask scrubber, C. Pohl	213,447
Barrel cover, Black & McManis	213,316
Bellows valve, Badger & Benjamin	213,375
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Bolter furnace and feed water heater, P. Sullivan	213,468
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Mail bag deliverer and receiver, J. Southwick	213,463
Match safe and candle holder, F. A. Farrell	213,406
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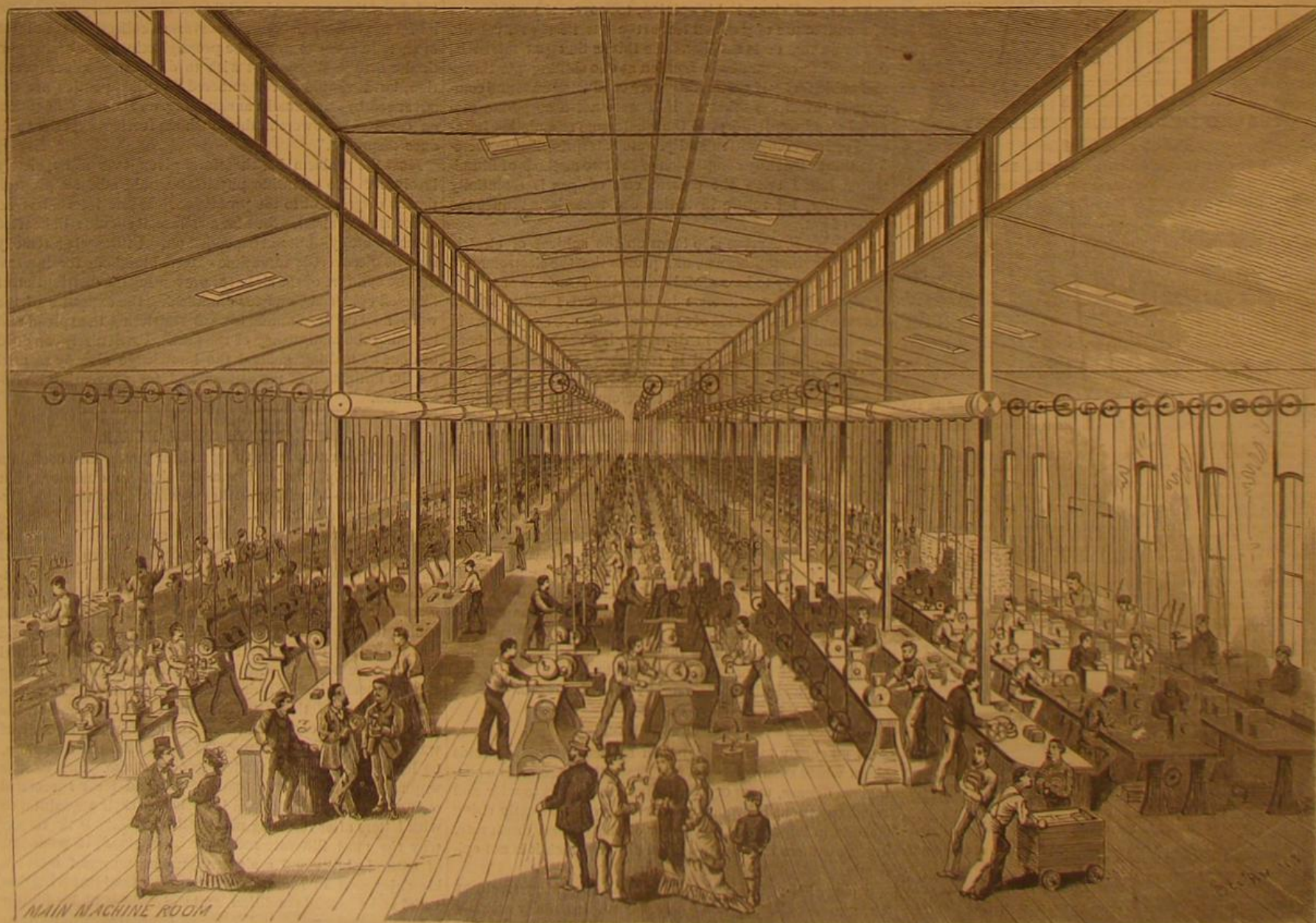
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[Continued on page 274.]



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- VI. MEDICINE, HYGIENE, ETC.—Hart Clot in Pneumonia, and Hypochondriasis. Clinical lecture by Prof. ALFRED L. LOOMIS, of the University of the City of New York.
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 Treatment of Distemper in Dogs.
 A New and Cheap Self-Generating Disinfectant.

PROGRESS OF ELECTRIC LIGHTING.

While the sensational reports in regard to electric illumination have subsided, the electric light is making friends in various quarters. The Waltham Bleachery, Mass., have been using two generators of the Wallace-Farmer pattern. Ten lights supply 112 four foot gas burners. The generators require twelve horse power apiece, and the horse power is estimated at one cent per horse power per hour. It is stated that the quality of the light is good; no complaint is made of its flickering. Washburn & Moen, of Worcester, Mass., use the Brush electric light to a limited extent, lighting but a portion of one of their works. They state that they get much more light than from gas for an equal expenditure of money. No accurate experiments, however, have been made.

The Riverside Mills, of Providence, R. I., employ two Brush generators. One machine has been running about two months in a weaving room, and part of the rest of the mill has also been lighted by electricity. These mills run night and day, and use a large number of gas burners from 10 to 12 hours per day, and therefore are peculiarly well fitted for the employment of the new light. Twenty electric lamps have taken the place of 230 five foot burners in a weaving room, and give a better and more satisfactory light. The work requires an unusually strong illumination.

The lighting of the Boston Music Hall by electricity has been postponed until a larger machine of the Brush pattern can be completed. In the preliminary trials it was found that the light would be unpleasant to a general audience, and it is therefore proposed to modify its color and brightness by the employment of suitable glass or porcelain shades.

W. Mattieu Williams, F.R.A.S., in a recent paper gives an interesting resume of early English experiments on incandescence, particularly those by a Mr. Starr. The latter devised a peculiar method of winding the conductors of a dynamo-electric machine. Since the thick copper wire, usually made use of, necessarily is wound on the armatures in a spiral, there is a certain loss of compactness and an increase in resistance, which Mr. Starr proposed to obviate by using a core of square section, and winding around it broad ribbons of sheet copper, which were insulated by cementing on its surfaces a layer of silk ribbon. This ribbon is to be laid with one edge against one side of the core and carried on until the angle, then it is to be turned over so that its opposite edge may be laid along the next side of the core, and so on. It seems as if this method of winding dynamo-electric machines would have certain obvious advantages. The experiments of Starr, however, on lighting by incandescence did not result in much success, and they were unfortunately brought to an end by the untimely death of the inventor. Prof. Williams, who has devoted much attention to the manufacture of gas, believes that there is a greater field for invention in gas manufacture than in the field of electric illumination. The by products, ammoniacal salts, liquid hydrocarbons, and coke, are sufficient, in his opinion, to cover the whole cost of manufacture of gas, and leave the gas itself as a volatile residuum that costs nothing. He thinks that gas might be delivered to consumers in London at one shilling per thousand cubic feet "if gas making were conducted on sound commercial principles—that is, if it were not a corporate monopoly, and were subject to the wholesome stimulating influence of free competition and private enterprise." He therefore thinks that any comparison of the two methods of illumination based upon the present cost of gas is essentially misleading, for future invention can materially reduce the price of gas.

Prof. W. E. Ayrton also takes up the subject of electric lighting by incandescence, and proves that the electromotive force necessary to be maintained at the two ends of a wire of platinum, 5 centimeters in length and 1 millimeter in diameter, and at the ends of a piece of carbon, 2 centimeters in length and 1 millimeter in diameter, is 0.2848 volt, or about one-third of a Daniell's cell in the case of the platinum, and 0.46013 volt, or about one half that of a Daniell's cell in the case of the carbon wire. It is, therefore, possible to produce a light with an electromotive force less than that of a Daniell's cell, but not with a Daniell cell itself, since the internal resistance of the cell is far greater than that of the incandescent wire or rod of carbon. He was enabled to use the method of incandescence in 1873, when the government was employing divers to recover the property sunk in the French mail steamer Nil off the coast of Japan. An ordinary carbon rod was first scraped very thin, and then, with connecting wires affixed, it was placed in a vacuum globe; and by heating it with an electric current, and passing air through the globe, it was burnt to the required degree of thinness; the current was then stopped and the air pumped out and replaced by nitrogen. The agitation of the subject of electric illumination certainly will provoke inquiry into the subject of the cost of gas, and, therefore, ought to be encouraged.

SCARLET FEVER.

As an enemy to life and health scarlet fever now stands about where smallpox did a few generations ago. It is a contagious disease, more or less malignant, subject to wide and rapid variations in scope and severity, yet apparently rising steadily in importance as a factor of the general death rate. Just now there is scarcely a large city in which it is not epidemic.

Seeing that medical skill has been able to bring smallpox under practical subjection, there has very naturally arisen a popular feeling that medical science ought to be equal to the task of discovering a means for preventing scarlet fever, at least as efficient as vaccination has proved in the case of

smallpox; and when this expectation has been unreasonably encouraged by the confident assertions of over-sanguine practitioners and theorists, that this, that, or the other drug may be counted on as a sure and trustworthy means for securing immunity from the scarlet fever, it is not surprising that people are disappointed by the failure of the medical profession to arrest the spread of the disease, now the most destructive of all the infectious diseases.

That the failure has not arisen from lack of effort on the part of the profession, medical literature abundantly testifies. That final success is not impossible no one would have the presumption to assert, though the prospects of immediate success are far from bright. The cause of the disease is as little understood as its cure. The microscope is as helpless as the telescope to detect the contagious principle, and no means for destroying it has been discovered, except a temperature higher than any patient can endure.

Inoculation seems to be almost universally attended with unfavorable results. Balladonna, so long insisted on as a prophylactic, fails to justify its reputation; and the long list of anti-fermentatives and similar remedies offers nothing that the experienced practitioner can resort to with any confidence in its efficacy.

"Indeed," says the editor of the *Medical Record*, "the logic which leads to the administration of any known anti-fermentative as a prophylactic has too unstable a ground to deserve much respect. In the first place, the question of what is the contagious principle of scarlatina has not yet got beyond the domain of probabilities. We can say, with much positiveness, to be sure, that it is no visible form of bacterium or micrococcus, and we can, perhaps, infer from analogy that it is a particulate something too small to be detected by the microscope, that it is albuminoid in composition, and multiplies at the expense of physiological processes. Whether it is living or dead, whether it is the degenerated protoplasm of man or the modified protoplasm of vegetable, whether it acts in conjunction with bacteria or feeds directly upon the tissues, all these questions are much beyond the pathologist as yet. But, in any case, it is very hard to see how anti-fermentatives can reach this virus. If it is dead, we certainly need not give such drugs to kill it; if it is living, there is no evidence or probability that the system can be so saturated as to destroy such infecting protoplasm and not the living matter of the tissues at the same time. In the blood of persons deafened with quinine or salicylic acid the bacterium disappears with as much activity as elsewhere, and the amoeboid movement of the white blood corpuscles can still be easily seen. It is a fact, to be sure, that there are drugs, like quinine, which affect the size and internal movements of the blood globules, but we cannot infer from this that there are prophylactic germicides, which will not prove to be homicides at the same time. The idea, then, we repeat, that anti-fermentatives will be efficacious, though not impossible, is inherently improbable, while the idiosyncrasy of the scarlet fever poison will oblige observers to collect a vast number of cases in order to prove the prophylactic power of any particular drug. We do not wish to discourage experimentation, but it should be remembered that therapeutics are not advanced by continually announcing on the basis of a dozen cases new powers in drugs which further experience at once disproves."

Must the problem be, therefore, given over as hopelessly insoluble? No scientific physician would admit a proposition so disgraceful to the profession. While internal medication is recognized as thus far a failure, it should still be tried experimentally—but not depended on. Ultimately a remedy may be discovered; meantime external methods for increasing the comfort of the sick, for preventing the distribution of infected epidermis, and for diminishing the exposure of the well, may do very much toward restricting the spread and lessening the malignancy of the pest. Particularly can good be done by making general the knowledge already assured for the mitigation of the disease and for preventing its distribution.

BETTER LATE THAN NEVER.

It is not an uncommon thing to hear young men complain that their early schooling was deficient in quantity, poor in quality, or—if neither of these—was wasted through boyish indifference and folly. They would get on better in life if they knew more, they are free to admit, but they do not see that they are daily wasting opportunities which, if improved, would in a few years give them a fairly good education. They think themselves too old to learn, and spend more time regretting their lack of knowledge than would suffice to give them the knowledge they need. It is said that the father of Professor Sumner, of Yale College, could neither write nor read when he came to this country, a young English mechanic. Within twenty years thereafter he was known as one of the best read men in Hartford, one of the most cultivated communities in the country. Instead of wasting his time in idle regrets for his deficient schooling, he learned to read, and read to good purpose. In a similar way many of the best, most honored, and most successful men our country has known have begun their acquaintance with letters after reaching manhood; and there is no reason why the most illiterate mechanic in our land, if possessed of natural ability and a sincere purpose, may not increase his enjoyment in life, his opportunities for improving his social and financial condition, and the chances of his family for the highest success in life, by an honest effort to retrieve by study the disadvantages by which early poverty or lack of educational opportunities has surrounded him.

MUSEUMS OF EUROPE.—METROPOLITAN MUSEUM OF ART.

As educators of the people the public museums of Europe perform no insignificant service. The artist and the artisan are not only allowed free access to such picture galleries and museums, but are encouraged to study and copy from the beautiful objects of art there exhibited.

Societies under various names, and patronized by the opulent and learned, and often supported in part by the government, award prizes for superior workmanship to those who copy or improve upon the original designs.

We read in a London contemporary that the new Sèvres Museum is doing its utmost to afford valuable instruction to those interested in studying the history and the progress of ceramic art. During the last few months a methodical classification of all the examples exhibited has been accomplished, and each one is classed according to its historical and geographical position as well as with regard to its technical worth. For this purpose labels are attached to all the pieces, giving the date and place of manufacture and the marks on various pieces, so that a wide knowledge can often be gained of a subject merely from studying these labels, 4,000 of which have lately been affixed. It is to be wished, says the same paper, that South Kensington could be made equally instructive in the way of ceramic labels.

Pity it is that our new Metropolitan Museum of Art is situated so far from the heart of this city as to render it almost unavailable to strangers, and to that class of residents who much appreciate its treasures, and who would derive the most benefit from frequently visiting it. But its inconvenient location in a hollow at the upper side of the Central Park is not the worst feature. The building itself is so lacking of architectural beauty—is such a monstrosity in design—that the visitor is almost repelled from entering after reaching it. Certainly but a fraction of the number who visited the Metropolitan Museum of Art when it was located in Fourteenth street will pay it a visit in its present out-of-the-way position.

BARFF'S NEW PROCESS FOR PRESERVING IRON.

Professor Barff lately gave a lecture in London on the results obtained by his new process since its first announcement, about two years ago, an account of which was then published in the *SCIENTIFIC AMERICAN*.

The process consists, in brief, in subjecting the surface of the iron to the action of superheated steam at a high temperature. The result is the production upon the surface of the iron of a hard, smooth, and durable skin of black oxide of iron, which prevents rust far better than any paint, lacquer, rubber, or other compound or process heretofore known.

Iron articles to be treated by this new process are first cleaned with dilute sulphuric acid, and afterward with bran water. They are then placed within a muffle, the temperature of which is 500° or 600° Fah.; dry superheated steam at a temperature of 1,000° Fah. is admitted, atmospheric air being carefully excluded. The formation of the black oxide skin rapidly takes place.

This coating has peculiar properties. It is so hard that it resists emery powder and the file. Many substances which adhere to ordinary iron will not stick to this prepared iron. For cookery the new process is especially useful. Barff stew pans and other utensils are more cleanly, as arrowroot and other substances can be cooked in them and the vessel cleaned with great ease. Barff vessels can be heated red hot without injuring the skin. Barffed iron is proof against damp, water, hot or cold, and stands exposure to the weather far better than galvanized or painted iron. Barffed boiler and ship plates, whether of iron or steel, are superior to all others, as they do not corrode and sediment does not readily adhere. The process is applicable to almost every conceivable form of iron manufacture, and appears to be a scientific, important, and valuable contribution to the industrial wants of the world.

Professor Barff's interesting lecture is given in full in the current issue of our SUPPLEMENT, No. 174. See table of contents in another column.

VERMONT MARBLE.

Prof. J. P. Henderson, of Loyola College, Baltimore, Prof. J. E. Watson, of Oberlin College, Ohio, and some students of mineralogy, have been testing the capacity of Vermont and other marbles and other monumental stones to withstand the corroding influences of our climate. The results appear in a long letter from Prof. Henderson to the *Nashua* (N. H.) *Gazette*. Their first examination was of granite, of which 382 different specimens were tested. While the most of these were composed of such material as would wear tolerably well in the open air, nearly every piece showed a lack of ability to withstand long exposure to rough weather.

Marble was then tried, and as Vermont and Italian marbles are most used for out-door monuments, attention was given chiefly to these. The principal quarries of Vermont are the West Rutland, Sutherland Falls, East Dorset, Pittsford, and Columbian. In point of durability, the West Rutland marble was found to take the precedence, and the others followed in the order of their names. They found also that our native Vermont marbles are better adapted to stand our climate than the Italian, which is rapidly going out of use, and will most likely disappear entirely for outside work.

Prof. Henderson says: "The depth of most Vermont quarries now is such that better marble is obtainable than was produced by them three years ago. Hence our verdict, as

rendered by the above course of research and reasoning, is, don't select as stock for cemetery work marble of a dark or bluish cast, but, rather, select the light color with greenish cloud."

The Gary Motor

To the Editor of the *Scientific American*:

In your issue of April 5, page 209, you publish a letter from me and make the following remarks: "None of the experiments here mentioned by Mr. Gary are new; there is no neutral line in any such sense as he asserts; what he above especially claims as his discovery is simply a very old, well known phenomenon imperfectly and erroneously alluded to in his italics. . . . All he appears to have done is to revive a few time-honored experiments, and trot out before the public an ancient perpetual motion delusion."

With all due regard for the opinions and assertions of the *SCIENTIFIC AMERICAN*, may I take the liberty to ask it to "trot out" before its many intelligent readers some of those "time-honored experiments," or tell them where they may be found; and will it also tell them where the "old and well known phenomenon" alluded to in my italics may be found, and in what manner I have imperfectly or erroneously alluded to it?

Surely the *SCIENTIFIC AMERICAN* must be in position to do this, as "time-honored experiments" must be on record. Can the *SCIENTIFIC AMERICAN* refuse to do this and maintain its well-earned reputation for fairness and ability?

W. W. GARY.

Huntingdon, Pa., March 31, 1879.

REMARKS.—In the letter of Mr. Gary's, published in our paper of April 5th, after describing his experiment of bringing a bar of magnetized iron into the vicinity of a magnet, he says: "What I claim as my discovery is that the iron, if of proper proportions, will change its polarity before it comes in contact with the magnet."

This alleged new discovery we specified as old and well known. Mr. Gary now desires us to state where this old and well known experiment may be found described. We will not now occupy space further than to give one reference, because the phenomenon is very familiar to experimenters. Mr. Gary will find it in "Rudimentary Magnetism," Snow Harris, 2d edition, revised by Noad (London: Lockwood & Co., 1873), page 31.

The author, in describing the influence of the pole of a magnet upon a bar of soft iron, says:

"It is, however, to be observed that the mean line will vary with the distance of the iron from the magnetic pole, and will approach the center of the iron as we increase its distance from the pole, and conversely, will approach the near extremity as we decrease its distance from the same pole; so that on making contact with the magnet the mean line vanishes, and the whole mass exhibits the same polarity as the pole of the magnet."

This may be readily demonstrated with an armature of considerable width, and the fact holds good in an armature of any kind. This affords the true explanation of Mr. Gary's sheet metal and tack experiment; shows the non-existence of any neutral line in the sense by him asserted; and proves that his alleged new discovery is simply a very old, well known phenomenon, imperfectly and erroneously set forth in his claim.

Mr. Gary claims from first to last that there exists in the magnetic field a neutral line, where the polarity of an induced magnetized iron bar ceases and beyond which it changes.

A method of proving that there is no reversal of polarity in the iron is illustrated by the accompanying engravings. Two helices without iron cores, having opposite poles

pointing in the same direction, are connected with a battery, as in Fig. 1. When the armature is remote from the helices, polarity manifests itself in the bar in accordance with the established laws of magnetism, and a needle presented to the N end will have its S end attracted. On moving the armature quite near the helices the same end of the armature will repel the S end of the needle and attract the N end; but the polarity of the armature has not been reversed, anomalous as it may appear. This may be verified by disconnecting the battery, as shown in Fig. 2, when the magnetism remaining in the bar will be found the same as in its first position in Fig. 1.

As to the possibility of making the force of permanent magnets available as a source of power, Mr. Gary absurdly claims to cut off the attraction of the magnet by the use of a thin piece of sheet iron placed on his so-called neutral line; but this is no cut-off.

The sheet iron acts simply as an induced magnet of very little power, sufficient, of course, to affect the delicately poised needle placed in its immediate vicinity; but when the needle is removed a short distance from the sheet iron

armature, the superiority of the inducing magnet will assert itself, and the needle will obey it almost as if no armature were present.

As there is no real basis for Gary's pretended claims to a new discovery concerning magnets, it follows that he is no better able to make a magnetic perpetual motion machine than his various predecessors. Some very curious frauds have been perpetrated in this line. Dircks, in his "Perpetuum Mobile," describes and engraves some alleged magnetic perpetual motors, one of which is stated to have been seen in the year 1821 in actual operation by crowds of people. Like Gary's, it was alleged to be run only by permanent magnets; but it was subsequently found out to be a deception.

We were called upon recently by a gentleman who stated that he was the friend and helper of Mr. Gary. He averred that he had himself seen Gary's magnetic motor in operation; that as many as three hundred people had also seen it. All we can say is that if the witnesses suppose that the machine was worked by permanent magnets, like many people before them, they were grossly deceived.

The Plague in Russia.

There is no doubt, says the *London Lancet*, that the medical profession in Russia are at the present moment in a state of profound unrest as to the near future of plague there. From the beginning of the outbreak in the province of Astrakhan, there has been a fear—determined perhaps by the course which the plague pursued during its recent prevalence in the province of Ghilan, Northwestern Persia—that this outbreak was probably but the forerunner of a wider and more serious manifestation in Russia which might be looked for in the course of spring. The cessation of the outbreak in the province of Astrakhan has not in any degree modified this view of the subject, and as the spring draws on expectation is on the alert to distinguish the first indications of that which is dreaded. The occurrence of another and happily not fatal case of plague within the infected area on the Volga, in the course of last week, gave rise to a momentary fear that the period of intermission between the forerunning outbreak and the greater invasion apprehended had come to an end. It is not, however, the indication in this direction which exercises at the present moment the minds of our professional brethren in Russia. Their attention is fixed upon seeming forerunners of the dreaded malady, which would appear to be scattered almost over the whole area of Russia in Europe. Our readers will remember the case of bubonic malady, unattended with much general disturbance of the system, which Professor Botkine observed a few weeks ago in St. Petersburg, and which he pronounced to be the slight form of plague which often precedes the deadlier manifestations of the disease. The weight of medical opinion in St. Petersburg declared itself against Professor Botkine's view of this case.

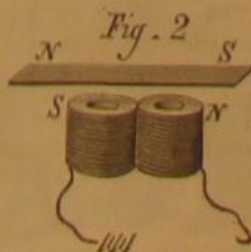
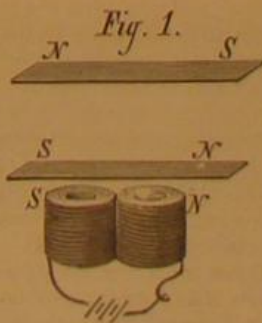
It is now known that the case in question is not the only one of the sort which has occurred in St. Petersburg, and that the later cases have been free from the complications which led to doubt in the earlier case. It is now known, too, that similar cases of this dubious bubonic affection have been observed also in Vitebsk, Tsaritsyn, Odessa, and in Warsaw; and it may be inferred that there is at present widely scattered in Russia a form of bubonic disease, of seemingly trivial character, unfamiliar to the medical profession there, and which it is feared may be of the sort which preceded the several recent appearances of plague in Mesopotamia, which occurred also prior to the late outbreak of plague in the province of Astrakhan, and which is, in fact, a form of plague.

Under these circumstances, it can be understood with what anxiety the near future as to plague is regarded in Russia by those who are most competent to judge of the possibilities of the case, and how anxiously obscure forms of disease are now being scanned over a large part of that empire. It is well that this state of things should be fully apprehended here. We shall not now have long to wait before the fate of Russia and our own prospect as to plague for the present year may be determined. But with the events of the Mesopotamian and Persian outbreaks before us, if Europe should be so fortunate as to escape from any further appearance of plague this year, it will be premature to think we have escaped with only the circumscribed explosion on the Volga until another winter and spring has passed.

Iron in New Zealand.

The Government of New Zealand has, within a few years, constructed over 1,000 miles of railroad, all the material for which, except the sleepers, have been carried out at a heavy charge in the way of freight, etc., from England. The present Minister of Public Works, the Hon. James MacAndrew, has determined to make the experiment of promoting the iron industry in the colony, and has, in the terms of the advertisement, which we published last week, calling for tenders for 100,000 tons of steel rails (or any portion thereof) to be manufactured in the colony from New Zealand ores.

A pamphlet containing full information on the subject, illustrated by maps and plans, has been published by order of the Government, and may be had from the Agent-General of the colony, Sir Julius Vogel, K.C.M.G., at 7 Westminster Chambers, London, by ironmasters and others desirous of obtaining further information on the subject.



[Continued from first page.]

the other. Power is distributed from four main lines of shafting, which have not perceptibly deviated from correct adjustment since they were first placed in position, thirteen years ago.

In this room there are no less than 1,003 separate machines for special mechanical operations, a large portion of which are automatic—that is to say, practically speaking, possessed of such intelligence and skill as to direct and control their own movements—only needing consciousness to rise to the plane of the skilled mechanic.

The number of driving belts which meet the view in this one room is, by actual count, 1,676, of the total length of 39,510 feet, or but 90 feet less than $7\frac{1}{2}$ miles. This is exclusive of short feed belts, etc., of which there are probably as many more.

Here may be seen good examples of the economical results of the division of labor. Take, for example, the rotary hook. No man makes a hook. It is forged here, turned yonder, one machine makes this cut, another that, and so it is passed on from machine to machine, until after 128 distinct operations, that one part is completed, inspected, and ready to take its proper place. So the making of a glass presser involves, we are told, 32 different operations, and a hemmer 70.

In neighboring rooms are the plating, japanning, and ornamenting departments.

We were struck with the apparent excellence of the japanning, its smooth surface and brilliant luster, and were surprised to find, upon inquiry, that by peculiar processes and materials this extraordinary finish was produced more expeditiously, and at less cost, than ordinary and inferior work.

Here we may remark that, being given the liberty of the shop, we improved the opportunity to make inquiries, and in our probings for information one of the mechanics "let out" to us the following: Upon one occasion when Mr. Wheeler (the president) was deeply interested in improving the process of japanning, he stripped off his coat and put his hands to the work to demonstrate how it should be done—not a rare thing for him to do.

A Hibernian employe, happening to see him thus engaged, and not knowing or not recognizing the man, exclaimed to one of the workmen, "Be gorra, but it must be hard times outside!—to see a fine appearin' gintleman like that, rubbin' machines at a dollar and a quarter a day!" If we ought not to have repeated this anecdote, we beg pardon of whoever may be offended.

One of our sketches shows a portion of the assembling room. Here is illustrated the mechanical precision resulting from making all parts of the machines to exact gauge.

In assembling a machine each part is taken from an indefinite number of that kind, yet all come together with the most perfect fit. In other words, all parts of the same kind are perfectly interchangeable. The holes for the shaft bearings in the beds of the machines are reamed out with diamond reamers, producing a perfectly true and polished interior surface, the contact between which and the shaft, though airtight, allows perfect freedom of motion.

For each part of the machine a standard model and a standard gauge are carefully kept, by which the working and inspection gauges are tested from time to time, and kept in the highest degree of exactness.

—cutting, grinding, and tipping the blank, swaging, cutting to length, rough-pointing, tipping, grooving, eye punching, burring, hardening, tempering, polishing, brushing, scouring, buffing, etc., etc.—now number thirty-three, having been recently reduced from fifty-two by improved machinery.

In this department, as may be seen by our illustrations, useful employment is found for the gentler sex.

The buildings of the woodworking factory, or cabinet works, are two in number, each 526 feet in length. Here is made all the furniture for the machines, from a plain table top to the most elaborate and expensive full case or cabinet.

The raw material is cut to dimension at the company's mill in Indianapolis, and transported here to be worked up into the desired forms.

The company's aim is to produce, for general purposes, substantial and well finished rather than simply showy work. In this department, as in all others, every piece of work is subjected to the most rigid inspection, and if any be faulty in any particular it is rejected.

A noticeable feature here is the perfect smoothness and luster produced in finishing the surface of the wood. For this purpose is used a "wood-filler," invented and patented by Mr. Wheeler, by means of which, we are told, the time, labor, and cost of wood finishing are materially reduced, with the production of better results as to the finish itself, the natural beauties of the colors and grain of the wood being fully developed and permanently fixed.

Some of the salient features of the processes of production having been thus briefly touched upon, the conclusion will have been anticipated that the complete products themselves are in all respects thoroughly substantial and as

nearly perfect as can be made from the best materials by the most skilled labor with the most effective appliances. These products consist of sewing machines of various styles, suited as well to the heaviest manufacturing in cloth and leather as to the lightest domestic purposes.

In the heat of the lively competition which has existed for years among the rival manufacturers of sewing machines, it has been the custom for each company to claim that its particular machines were the best in the world.

There are few sewing machines that are not very much better than none. As we said at the outset, it is no part of our purpose to judge of their relative merits; but the fact that at the Paris Exhibition of 1878, the only grand prize for sewing machines from all the world was awarded to the Wheeler & Wilson Company, as is attested by the highest authorities, certainly indicates that the claims of superiority on the part of this company are far removed from idle boasting. At all events, it is gratifying to be able to state the



WHEELER & WILSON SEWING MACHINE MANUFACTORY.

fact that throughout the world American products in this branch of industry are more highly esteemed and fetch a materially higher price than those of any other country.

Enormous Public Works in France.

While England is groaning under the effects of a commercial depression which promises to be of long continuance, France, though it has its share in the general stagnation of trade, is occupied with gigantic projects for public improvements. The Republic, scarcely less than the Empire, adopts the paternal theory of government, and is setting itself to work to add incalculably to the means of internal intercourse and the facilities for commerce while providing employment for its laborers.

This theory of government is by some considered to be a false one, but it can be easily shown what can be done under it in the direction of public improvements. So the drainage of Haarlem Lake was done, and that of the Zuyder Zee in Holland is now being done by the Dutch government, which guaranteed the investments made by the capitalists. The only question to make such governmental management successful is whether honest men can be found to direct it. Unfortunately, as the majority of our government employees are politicians, and these, as a class, cannot be quoted as examples of honesty and disinterestedness, it is better for us to keep the government entirely out of all such enterprises, which experience has proved can be done quicker, cheaper, and better by private contract.

M. de Freycinet, the Minister of Public Works in France, has outlined a scheme of railway, canal, and harbor extension, for 1879, which will cost the enormous sum of \$800,000,000, and will probably have legislative sanction for it in its entirety. The money for these unparalleled works he proposes to raise by an issue of three per cent bonds, redeemable in seventy-five years; and that he can get the whole amount without trouble the experience of all recent French loans affords abundant proof. The new chance for investment is eagerly awaited by capitalists, large and small; for enormous sums are now lying idle in bankers' hands.

One of the main features of the plan, and that which will consume the greater part of the vast appropriation, is the extension of the railroad system of France. The rest of the money will mainly go to the construction of new harbors and the improvement of the old ones. Another great public work which is urgently demanded by several of the departments is a canal from Creil-sur-Oise to Beauvais, Amiens, and Albert, with two important branches. It is averred that this extensive canal would be of the greatest value to the north of France; and it would certainly be the most considerable of all navigable French waterways, and would have the effect of reducing by one half the present freight charges from English ports to Amiens, Paris, and beyond.

A scheme for the construction of a network of metropolitan railways in Paris was hardly perfected before M. de Freycinet stepped in and claimed the perfected lines as belonging to the category of lines of general interest. Their concession has therefore been transferred from the Municipal Council to the general government. The cost of their construction is estimated at nearly a million dollars a mile. The Minister of Public Works has also obtained the appointment of a supreme commission on the treatment and utilization of French rivers, composed in equal thirds of legislators, officials, and manufacturers or agriculturists. It will consider irrigation, motive power, inundation, water supply, sewage, and similar questions. Add to all this his vast project of harbor improvement, and we see that M. de Freycinet has laid out a scheme of public works for France which will occupy the Republic for many years to come, constituting a system of internal improvements of extraordinary magnitude, which, if it is successfully completed, will itself make the new Republic memorable for generations.

One of the most interesting features of the plan is the construction of what are known as light or narrow gauge railways, largely as feeders to the main lines, on the most extensive scale. A commission was appointed last January to examine into this class of railways, both at home and abroad, and report on its value and feasibility; and the result of their inquiries has determined M. de Freycinet to build the nar-

row gauge railways throughout all France. The English engineering journals find fault with the conclusions of this commission, but they are very interesting.

They recommend a reduction of the gauge to 1 meter (3 feet 3 3/8 inches), and in some instances even to 75 centimeters, 3/4 of a meter (2 feet 6 inches), whereas in England a 3 foot gauge is preferred. They advise the dispensing with fences except at especially dangerous points and near dwellings; that the stations should consist merely of a waiting room, ticket office, and station master's lodgings; that the cars should be of two classes, with possibly an upper story; that they should be without useless ornamentation; and that the rolling stock should be at a minimum—in fact, that everything should be arranged with a view to strict economy. Under these conditions they estimate the cost of the roads, per mile, at an average of about \$22,000. They put th



SEWING MACHINE MANUFACTURE.

average speed at from 9.3 to 12.4 miles an hour. The subject of narrow gauge railways is now one of the most interesting in the whole range of railway questions, and it is well worth careful thought and study. During the last few years they have been built more or less extensively here and abroad, and they are likely to come into still greater use, as being cheaper in construction and in working, especially in new countries.

RECENT MECHANICAL INVENTIONS.

An improved tenoning machine has been patented by Mr. George H. Gregory, of Cannon's Station, Conn. It consists in a revolving cutter stock, which is recessed and provided with cutter heads, which are adjustable both laterally and longitudinally. The machine is designed for cutting tenons of round and oval shape.

An improvement in steam boilers, patented by Mr. Stephen J. Gold, of Cornwall, Conn., has a series of water receiving pipes that extend through a portion of the fire chamber and

connect with the steam space. The object of the invention is to secure the maximum area of heating surface, together with the greatest compactness.

Messrs. B. J. Feldman and Theodore Schlag, of Franklin, Pa., have patented an improved fan for driving flies from the table. It consists of a novel arrangement of fans or feather holders, and mechanism for operating them.

An improved carriage step has recently been patented by Mr. Richard N. B. Kirkham, of Kansas, Ill. The step is arranged to fold up compactly, and is operated by a lever and a chain or cord.

Mr. William H. Stickle, of Terre Haute, Ind., has devised an improved vehicle spring which, it is said, overcomes the swaying side motion, the jostling, and bumping which are common to ordinary vehicles.

An improvement in pianoforte actions, recently patented by Mr. G. O. V. Roederer, of Indianola, Texas, is proof against atmospheric influences, all of the movable parts, as well as the supports, being made of sheet metal.

Mr. Theodore Bickerman, of Henry, Ill., has patented an improved windmill, in which the rim, spokes, and rods are made of gas pipe, securing both lightness and strength. The sails are made of sheet iron or wood.

An improved screw press, which may be operated by steam or horse power, has been patented by Mr. P. R. Campbell, of Hurricane, Miss. It consists of a combination of mechanism, by means of which a strong pressure is easily obtained.

Zenes McGinnis, of Petrolia, Pa., has devised an improved coupling for sucker rods of oil pumps, by means of which the rod may be coupled and uncoupled without ascending the walking beam.

An improved weighing scale, in which the weights are suspended so that when the material to be weighed is put into the scoop the weights are lifted one after the other until the desired weight is attained, has been patented by Mr. D. Hallock, of Cossackie, N. Y.

An improved log roller for transferring logs from the log deck to the sawmill carriage has been patented by Mr. Esau Tarrant, of Muskegon, Mich. It consists of a bar having movable ratchet teeth for engaging the surface of the log and in novel mechanism for operating the toothed bar.

Mr. John R. Fish, of Grand Rapids, Mich., has patented an improved locomotive smokestack, which contains a novel arrangement of spark arresters, which offer little obstruction to the draught, but effectually prevent the escape of sparks.

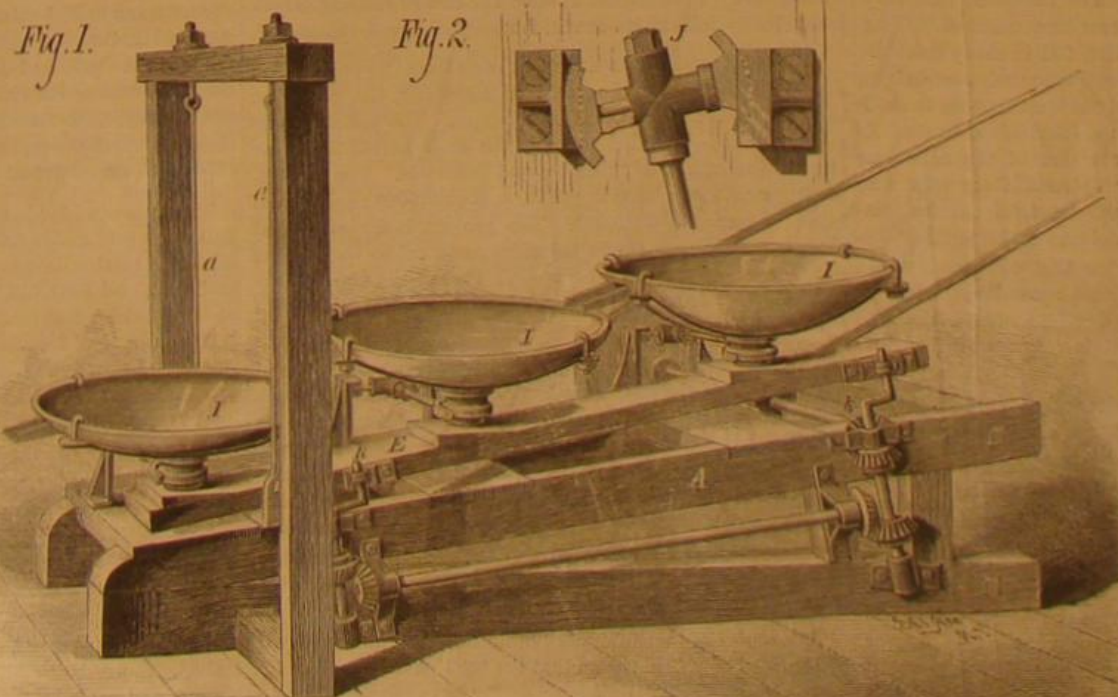
An improvement in rotary water meters, patented by Mr. Henry J. King, of Middletown, N. Y., is provided with a spiral screw for operating the registering mechanism. The screw is made in sections, and may be adjusted on its shaft, which is journaled in the water pipe.

AN IMPROVED AMALGAMATOR.

The accompanying engraving represents an amalgamator constructed on a novel principle, and having a peculiar arrangement of mechanism, by which an oscillating or vibratory motion is given to the amalgamated copper pans about their own axes while at the same time they are moved in a circular path and raised and lowered.

The pans, I, which are concave, are provided with internal rims or ledges, to prevent the swashing of the contents of the pan over its edges. Three or more pans are supported by short shafts journaled in the frame, E, which is suspended by the rods, a, from the standards of the frame, A, and oscillated by the cranks, k, whose shafts are connected by an inclined shaft and gear wheels so that they rotate together. The support of each pan is connected with the crosshead, J, by means of a short forked rod, which imparts to the pans an oscillating motion about their own axis as the supporting frame, E, is moved with a gyratory motion by the cranks, k, and is raised and lowered at its upper end by an eccentric on the upper horizontal shaft. Each pan is provided with a sheet iron spout, which discharges into the next below. The quicksilver readily unites with the copper to form an amalgam, which arrests the small particles of precious metal, and the escape of the quicksilver from the pans is prevented by the use of iron spouts, which do not become amalgamated.

This improvement was recently patented by Mr. Charles C. Peck, of Melrose, Mass.



PECK'S AMALGAMATOR.

RAILWAY NOTES.

At a recent convention of railway men in Boston a prominent speaker expressed great satisfaction in view of the improvements adopted lately by railway managers to increase the comfort and safety of trainmen and passengers; yet much more, he said, remained to be done. Among the improvements and economies of the near future there were named: An improved freight car coupling; a suitable power brake for freight trains; the Baltimore safety axle, with independent wheels; the rail system of electric block signals; gas for lighting and heating passenger cars, without danger from fire in case of accident; shelter and protection for freight train men when on the road; and suitable resting and reading rooms for their comfort and improvement when waiting for delayed trains.

At the late meeting of the Master Car Builders' Association in this city, the safety of trainmen—or rather the urgent need of devices for enhancing their safety—was discussed at considerable length. The President, Mr. Leander Garey, spoke of the effect of interchanging cars, whereby the cars of each road are scattered all over the country, and the resulting need of much more careful inspection of freight cars. Inspectors look to their running gear, draw attachments, and brakes, but seldom or never to dangerous ladders, loose brake wheels, broken running boards, or other things upon which merely the lives of brakemen depended.

Letters were read from a number of master car builders, yardmasters, and others, in which the deficiencies of the average freight car were severely criticised. Among the improvements needed to lessen the risks of trainmen, a master car builder mentioned better steps for climbing the cars. Such steps should be at the ends of freight cars, and the one at the sill should be stopped, so that a man's foot cannot slip off. There should be a strong step secured to the side of the sill, with a firm hand-hold at a proper height above it. Then the steps should be made reliable. Too often they are fastened on simply with screws that have been hammered in to their heads, and consequently give way when a strain is put on them precisely at the moment when a man's life depends upon their solidity.

A yardmaster mentioned as causes of accidents to train hands, first, the different heights of the draw bars; second, the insufficiency of follower heads and springs, which should be strong enough to stand a reasonable concussion without giving way; third, to the different kinds of draw bars employed. He strongly urged the adoption of a uniform style of draw bar, and recommended the Safford as best for saving fingers and hands, particularly when accompanied by the Griffiths attachment, he approved of it. Brake staffs, he thought, should be uniformly on one side, not, as now, sometimes on one and sometimes on the other, so that oftentimes brakemen are injured for life, or even killed, by being caught between them.

Another yardmaster expressed the opinion that the general adoption of the Safford bar and its use at a uniform height from the track would render mutilations and deaths in the work of coupling at least infrequent—would, in fact, do away with 90 per cent of the present proportion of injuries.

The need of wider running boards on the tops of cars was also insisted on; as also were guarded brake wheels, and frequent reliefs of trainmen in bad weather.

The superior strength of American cars has been frequently shown in cases of derailment. Where foreign cars would have been knocked into kindling wood the American have withstood the shock wonderfully, to the relatively great protection of the passengers. An unusual and unusually severe test of their strength is reported in the *Journal of the Franklin Institute*:

When the Pennsylvania Railroad depot was demolished by a tornado last fall, a heavy car shed was blown over upon several trains of cars, which were under it, ready to be dispatched. So great was the strength of these cars that they held up the wreck. The 10 inch cast iron columns, 25 feet long, that supported the roof girders, fell in many cases directly against the cars with the force due to their own weight and that of the whole roof, probably at least six tons to each column, impelled by the force of the wind added to that of gravity. Notwithstanding this, not one of the cars was wrecked. In one instance a column struck a car near the middle and snapped off, but the framework of the car was not broken; the lower part of the column rested against the car, the upper part on its roof. A car that will stand, without injury, the impact of a 10 inch cast iron column, with six tons of extra weight, driven by a gale of 75 miles an hour, contains an excess of strength that is very assuring to the traveler.

In Russia the machinery of factories and the engines of railroads and steamers are chiefly in charge of foreigners, on account of the lack of experienced native mechanics. It is now realized that this state of things is neither economical nor patriotic; and besides there have been accidents because the foreign mechanics and engineers did not understand the Russian language. In order to bring about a change the government, in 1871, ordered the railroad companies to pay 15 rubles per verst (two thirds of a mile) for the establishment and support of railroad schools. About 320,000 rubles a year are collected under this order, and now there are about twenty such schools. Twenty more are to be opened this year. These schools are situated on the railroad lines, and each of them is provided with a machine shop, where every pupil is obliged to work not less than three hours daily. The full course requires four years. Each student chooses his

specialty as mechanic, engineer, or telegraphist. Besides these there are five conductors' schools. As the railroad schools have proved successful, other branches of industry are to follow the example. Many steamship companies and factories propose to establish schools to secure experienced hands for their service.

GREAT advantages are claimed for the Prosser "twin cylinder" cars for the transportation of grain. They are said to be cheaper, lighter, more durable, occupy less space, easier draught, will not laminate the track, may be run at a greater speed, lower the center of gravity, reduce the windage of train, remove the weight of load from axle, require less oil, less attention, less parts, can dry wet grain in the car, and prevent it from heating, souring, or moulding while in transportation.

More specifically the elements of superiority of the new car are shown by the following figures:

ORDINARY FREIGHT CAR.

Weight of car.....	10 tons.
Weight of load.....	10 tons.
Weight of car and load.....	20 tons.
Amount drawn by engine.....	600 tons.
Weight of cars.....	300 tons.
Weight of load.....	300 tons.
300 tons.....	600,000 lb.
600,000 lb.....	10,000 bu.
10,000 bu. at 15c.....	\$1,500
Cost of transit.....	1,000
Profit.....	500

PROSSER CAR.

Weight of car.....	3 tons.
Weight of load.....	10 tons.
Weight of car and load.....	13 tons.
Amount drawn by engine.....	1,300 tons.
Weight of cars.....	280 tons.
Weight of load.....	920 tons.
920 tons.....	1,840,000 lb.
1,840,000 lb.....	30,666 bu.
30,666 bu. at 15c.....	\$4,599.96
Cost of transit.....	1,000
Profit.....	\$3,599.96

THE unpleasant noise of escaping steam from safety valves, open steam pipes, vacuum brakes, and the like, is said to be entirely suppressed by discharging the steam through a small chamber filled with glass or metal beads. The beads—from one quarter to five sixteenths inch in diameter—are held in place by copper gratings, and the steam is entirely silenced by its passage through the tortuous interstices between them. At the same time it escapes freely, with little or no back pressure. The device has been patented.

A BERLIN paper says, in regard to one of the steps recently taken toward concentrating the railroads under the government, that it is to be feared that when the private roads have ceased to exist, the State, as the sole possessor of the whole railroad traffic, will dictate much higher rates than are now had; and the fact that this can be done only through the law, and with the consent of the representatives of the nation, will afford in appearance only a protection against such an excessive increase of charges. For the administration will need, to justify the increase, only to show that the lower rates do not cover the working expenses and the interest on the cost of the roads; and as it at present works at greater expense than private enterprise, it will probably be easy to show that justification.

THE Grand Duke Nicholas of Russia has issued a pamphlet urging the speedy construction of an Orenburg-Tashkend Railway. His argument for this route, based on that of De Lesseps and Cotard, is, in brief, as follows: If a grand circle be drawn of the globe between London and Calcutta, the segment of it intersected between the two cities goes through Amsterdam, then a little south of Berlin, then through Warsaw, through Southern Russia to the Caspian Sea, which it cuts somewhat above 44° of latitude; then through the Sea of Aral, proceeds to the east of Samarkand, cuts the Indus about a hundred miles south of its great angle, and goes down the valley of the Ganges to Calcutta. Russia is in possession of the Asiatic part of that shortest route to India. She ought consequently to construct at once the line of railway which most closely follows it—to wit, from Orenburg to Tashkend.

THE construction of a line of railway from the port of San Jose de Guatemala to the town of Escuintla, the center of the chief coffee district, has been begun. The distance is 28 miles, and it is intended to build the road hereafter to the city of Guatemala, 32 miles beyond Escuintla. The government guarantees a certain profit on \$1,000,000 capital, and loans the company \$210,000. The project includes a final extension from Guatemala 140 miles eastward to the port of San Tomaso on the Atlantic coast. Part of the material has been shipped from San Francisco, with a large number of Chinese laborers.

THE lowest cost of carrying freight yet reported is found in the report of the Northern Central Railway for 1878, which gives the cost per ton per mile on the Susquehanna Division (47 miles long) as 0.35 cent per ton per mile. On the whole road, however, the average cost is about twice as much, and on one of its branches, 9 miles long, the cost is nearly ten times as much—3.246 cents per ton per mile. It is not often the companies report separately the cost on different sections of the same road. If they did, perhaps some of them would show a lower cost than this.

THE report of the New York State Engineer and Surveyor of Railroads for 1878 shows that the total paid up capital invested in the steam railroads reporting in the State is \$392,164,754.25, and the proportion for New York, pro-rating the roads lying in the State and in adjoining States, is \$287,826,957.05. This is an increase in the total aggregate of \$7,255,616.49. The paid up capital of the horse roads amounts to

\$23,167,130.36—a decrease of \$73,357.63. This decrease was caused by roads reducing stock.

The total number of miles of road built (main line and branches), including leased lines out of the State, is 8,390.73, of which 5,752.24 are in this State. The double track, including sidings, amounts to 4,358.33 miles. There have been 107.79 miles of steam, and 8.24 miles of horse railroads built during the year. The total miles of road owned by horse railroad companies are 426.03, and the double track and sidings are 278.19 miles.

The steam railroads doing business in this State own 2,801 engines, 1,993 first-class passenger cars, 358 second-class passenger and emigrant cars, 741 mail, baggage and express cars, and 59,413 freight cars. Of the 278 steam roads now in existence in this State, 47 companies operate their own and other roads, 5 are operated by receivers, and 1 is leased and operated by a private person. There are also 7 corporations formed under the laws of other States leasing and operating roads in this State—a total of 60.

Sixty-one horse railroad companies operate their own and other roads. Two steam roads, the New York and Harlem, and the Utica, Clinton and Binghamton, operate part of their roads as horse roads, and 2 are leased and operated by private persons—a total of 65.

There are also 2 steam roads owned and operated by private parties.

There are 71 steam and 4 horse roads leased and operated by other roads, and 1 road owned by private persons is operated by a steam railroad company; 72 steam and 15 horse railroads are not in operation.

The number of passengers carried by the steam roads was 48,769,084, an increase of 8,756,863; classifying the roads last year to correspond with the present report, and an average of 20.84 miles was traveled by each passenger. The horse roads carried 244,290,364 passengers during the year, an increase of 5,748,628. The number of tons of freight carried by the steam roads was 38,320,573, an increase of 3,335,792.

THE one thing wanting to make a direct railroad communication between India and Europe is a railway from Alexandria, the nearest point on the Persian Gulf, to Kurrachee. A committee has been formed in London, consisting of the Duke of Sutherland and several other noblemen and gentlemen, to acquire certain routes through the valley of the Euphrates to complete the connection. This done, it will be possible to go from London to Kurrachee in about seven days—a distance which it now takes nineteen days to cover.

THE Belgian Government has decided on the abandonment of wooden railway sleepers. Its example will doubtless find imitators, if indeed the example be not improved upon, and steel be used eventually instead of iron. It should be noted that it is not the longirine, or longitudinal sleeper, that has been adopted, but a German system of cross sleepers.

THE greatest railroads in India are composed of the Punjab and Delhi system, some 1,200 miles in length, meeting at Delhi the East Indian Railway, which goes to Calcutta, and which is about 1,000 miles in length, with a branch at Allahabad to Jubbulpore, some 250 miles additional in length. More, it connects with the great Indian Peninsular system which is carried on to Bombay, some 550 miles. This system runs through a chain of mountains, called the Thull and Vhrne Ghatz, where the engineering difficulties have been immense, and 15 miles of tunnel made. The line then runs from Poonah to Magpore, where it is connected with the Madras Railway, some 850 miles in length. This line also serves Bangalore, the garden of the Madras Presidency, and the coolest spot in the plains of India. In the same direction is the Hyderabad State Line, belonging to the Nizam. The Bombay and Baroda Railway runs to Giucwarah, thence through Central India to Ahmedabad, where it is connected with the Rajpootan State Railway, running to Delhi. At Calcutta is the Eastern Bengal Railway, which goes to Barrachpore, thence to Kooshteah, from which a line of steamers connects with Assam, the great tea growing country of India. In Oude is the Oude and Rohilkund line, which runs 500 miles through some of the richest plains of that fertile region. The noble bridge, about 1¼ mile in length, which spans the Ganges at Cawnpore, belongs to this company. These comprise the general grand trunk system of railways in India.

THE *Railway Age* has given a list of forty-eight railroads that were sold under foreclosure during the year 1878, representing a total mileage of 3,902 miles, \$160,014,500 of bonds and debt, and \$151,616,700 capital stock—the entire amount of bonds, debt, and stock being \$311,631,200.

A summary of foreclosure sales during the last three years stands as below; the moral is evident:

Year.	No. of Roads.	Mileage.	Capital Invested.
1876.....	30	3,846	\$217,848,000
1877.....	54	3,875	198,984,000
1878.....	48	3,902	311,631,000
Three years.....	132	16,623	\$728,463,000

A SINGLE locomotive on the Kansas Pacific recently hauled a train of 58 empty and 15 loaded cars, with caboose attached, from Ellis to Brookville, a distance of 102 miles, in 9 hours and 30 minutes. The monster locomotive "Uncle Dick," described in a late number of this paper, has already achieved distinction by climbing the steepest grade of the mountain division of the Atchison, Topeka, and Santa Fe Railroad, drawing 22 loaded cars.

HOUSEHOLD INVENTIONS.

An improvement in curtain fixtures has been patented by Mr. J. S. Henry, of North Belle Vernon, Pa. It consists of a suspended ratchet hook pivoted in front of the roller, and extended below the ratchet, to form an eye or loop for the cord.

An improved child's chair, constructed so that it may be readily adjusted as a high chair or carriage chair, has been patented by Mr. C. H. Barnes, of Poughkeepsie, N. Y.

A flower stand, provided with one or more trays, supported by a single central standard, has been patented by Mr. Thomas Murgatroyd, of Clarinda, Iowa. By slightly modifying the construction the stand may be used as a workstand.

An improved candlestick, which will hold the candle firmly, and yet admit of burning the whole of it, has been patented by Mr. A. J. Smith, of Ukiah City, Cal. It consists of a standard fixed to the usual bottom, and having a thimble with fingers or prongs, which slides over it and holds the candle.

A NEW CLUTCH PULLEY.

We present engravings of two forms of clutch pulley manufactured by Messrs. James Hunter & Son, of North Adams, Mass. In these pulleys a friction band is employed to clutch the boss of the wheel, and the means for operating the bands are both simple and efficient. In the form shown in Fig. 1, the pulley is placed on a sleeve, D, which is secured to the shaft, and is provided with a flange for receiving screws which enter the friction band, A. The latter surrounds an enlarged hub or boss of the wheel, and is split and provided with two ears, through which passes a bolt having a cam formed on its head that engages a similar cam formed on one of the ears. A lever, B, is secured to this bolt, and is curved so as to be engaged by a cone, C, on the shaft. The cone is grooved circumferentially to receive the fork of the shifting lever. It requires very little effort and only a slight movement of the shifting lever to operate the clutch. This device is so simple that no special description of its operation will be required.

By moving the cone, C, toward the pulley the free end of the lever, B, is thrown outward, the ring, A, is contracted, and the boss of the pulley is clamped so that it is carried around with the shaft.

The clutch shown in Fig. 2 is similar to the one just described, the difference being that a right and left hand screw passes through the ears, E, and is turned so as to contract the split ring by the action of the toggle, F, when the sleeve, G, is moved toward the pulley. Of course it will be understood that moving either the cone, C, or the sleeve, G, away from the pulley releases it. The device is applicable to both driving and driven pulleys.

Pumping Money.

The above may appear to be a somewhat singular title for a paper, but, according to the *Foreman Engineer and Draughtsman*, it is literally true that a vast number of sovereigns, and, indeed, of other coins, are annually pumped into existence at the Royal Mint. Without entering into a detailed account of the numerous processes and manipulations by means of which ingots of gold are transformed into small circular disks of metal, of the exact size and standards of weight and of fineness for the reception of impressions, it may be said that those impressions are finally due to the action of the air pump. A very large proportion of the sovereigns, therefore, issued from the mint presses since the erection in 1810 of steam machinery for the purpose of coining, have undoubtedly been pumped, as it were, into the channels of circulation. Let us, then, proceed to explain the contrivances and means by which the operation of pumping sovereigns is performed at the Tower Hill money manufactory. We will commence with the prime mover. This is a steam engine of twenty horse power, on the combined high and low pressure principle, and which was erected in 1846 by the justly celebrated firm of George & Sir John Rennie. Originally this engine was intended only for pumping water from a deep artesian well on the premises for the supply of the coining department, but in 1851 Mr. J. Newton advised that the engine in question should be made to pump money as well as water, and showed how it could be done. The merit of entertaining the proposition and of ordering it to be carried into effect certainly belongs to Captain (now General) Harness, R.E., who was Deputy-Master of the Mint in the year named. This highly talented officer gave instructions to the Messrs. Rennie for the construction, under the eye of the inventor, of the necessary apparatus and appliances for the purpose.

An air pump of considerable dimensions constituted the main feature of the scheme, and this was formed on a perfectly novel plan. It consisted of a cast iron cylinder, close-

ly resembling in exterior appearance that of an ordinary land steam engine, but very different in its internal arrangement. The piston of the pump was made up of a series of cast iron rings, and these were pressed out against the sides of the accurately bored cylinder by springs of steel. The effect was to make the piston perfectly air-tight, and yet capable of being easily moved upward and downward in the cylinder. There were no valves in the piston, as there are in those of almost all air pumps employed in manufacturing processes. The base of the cylinder was a hollow casting of iron, and so was its cover. In these hollow castings the inlet and outlet valves were placed. The upper casting contained sixty-four small apertures, which were covered by small pieces of steel saw-plate, each about two inches long by one inch wide, and fastened by a screw at one end. These delicate springs were, in fact, the valves. Thirty-two of them were made to open to the atmosphere, and thirty-two to the exhaust or vacuum pipe. The hollow base or bed plate of the cylinder was furnished in a precisely similar manner. The diameter of the cylinder was three feet six inches, and the length of stroke of the piston three feet. The pump was placed vertically, and immediately below the working beam of the engine to which the piston rod was attached.

By this method of construction the air pump became double-acting, and whether the piston was ascending or descending it constantly exhausted air from the vacuum tube through the inlet valves, and discharged it through the outlet series. Nothing in the shape of machinery could work more smoothly than did this pump, and this arose mainly from the peculiar character of the valves. The cost of the whole apparatus, with cast iron exhaust tube, two hundred feet in length, ten inches in diameter, and face-jointed, was about £400.

It has been said that the exhaust tube was two hundred feet in length. This arose from the fact that the engine

impact their impressions. The presses then rebound, carrying with them their pistons. The pneumatic valves again open self-actingly, the dies descend upon new blanks supplied to them by mechanical fingers, another batch of sovereigns is pumped into bright and glorious being, and so long as the great air pump is exhausting the vacuum chamber and the presses are fed with blanks, so long the series of minor pumps will proceed with their work, and streams of gold, silver, or bronze coins will flow down from the presses into reservoirs placed below to catch them.

The Academy of Sciences.

The annual session of the National Academy of Sciences began in Washington, April 15. Vice-President Marsh presided, and delivered the opening address, in which he paid a feeling tribute to the late President of the Academy, Professor Joseph Henry, and gave a review of the work of the body during the past year. The members present were Professor Spencer F. Baird, Professor Charles F. Chandler, of New York; Mr. E. D. Cope, of New Jersey; Mr. Theodore Gill, Professor Julius Hilgard, Mr. George W. Hill, of New York; Professor O. C. Marsh, of Connecticut; Professor Alfred M. Mayer, of New Jersey; General M. C. Meigs, Dr. S. Weir Mitchell, of Philadelphia; Professor Simon Newcomb, Professor H. A. Newton, of Connecticut; Professor E. C. Pickering, of Boston; Mr. Raphael Pumpelly, of New York; Admiral John Rodgers, of San Francisco; Mr. Fairman Rogers, of Philadelphia; Mr. Charles A. Schott, Professor W. P. Trowbridge, of Connecticut; Dr. J. H. Trumbull, of Connecticut; General G. R. Warren, United States Army; Dr. J. J. Woodward, United States Army; Professor Henry Draper, of New York; Mr. C. S. Pierce, Dr. S. H. Scudder, of Cambridge; Dr. Elliott Coues, Professor Francis S. Walker, and Professor G. F. Barker, of Philadelphia.

April 16, the venerable Professor William B. Rogers, "the Nestor of American Geology," was elected President of the Academy. The other officers were re-elected, as follows: Professor O. C. Marsh, vice-president; Professor J. H. C. Coffin, home secretary; Professor F. A. Barnard, foreign secretary; Mr. Fairman Rogers, treasurer; and Professors Baird, Agassiz, Gibbs, Newcomb, Hall, and General Meigs, the counsel.

The papers read the first day were as follows: "On Ghosts in Diffraction Spectra," and on "Comparisons of Wave Lengths with the Meter," by Professor C. S. Peirce, of Cambridge; on "The Relation of Neuralgic Pain to Storms and the Earth's Magnetism," by Professor S. Weir Mitchell, of Philadelphia; on "Continuation of Researches in Connection with the Discovery of Oxygen in the Sun," by Professor Henry Draper, of New York; on "Vowel Theories Based on Experiments with the Phonograph and Phonautograph," by Professor R. Graham Bell; and on "The Palaeozoic Cockroaches," by Dr. S. H. Scudder, of Cambridge.

The programme for the second day's session included papers by Mr. E. C. Pickering, on the "Eclipses of Jupiter's Satellites;" by Mr. C. S. Peirce, on "Errors of Pendulum Experiments," and on "A Method of Swinging Pendulums," proposed by Mr. Faye; by Mr. E. W. Hilgard (read by Mr. Pumpelly), on "The Loess of the Mississippi and the Aœlian Hypothesis;" by Professor J. Le Conte (read by Mr. S. K. Gilbert), on the "Extinct Volcanoes about Lake Mono and their Relation to Our Glacial Drift;" by Professor J. E. Hilgard, "Report of Progress of the International Bureau of Weights and Measures;" by Mr. G. K. Gilbert, on "Stability and Instability of Drainage Lines;" and by Professor C. F. Chandler, on "Polariscope Methods."

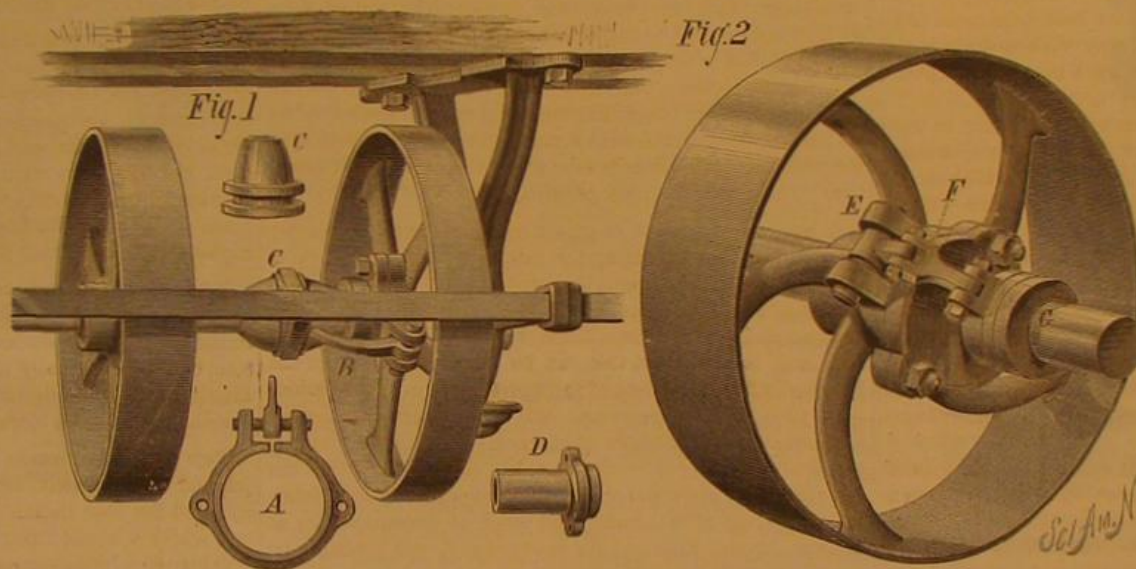
Among other papers announced were "Critical Remarks on Observations Alleged to be of Intramercorial Planets," by C. H. Peters; and on "The Extinct Species of Rhinoceros and Allied Forms of North America," by E. D. Cope.

The New York World's Fair.

At a recent meeting of the Executive Committee of the United States Board of Trade, and the members residing in New York, the decision of the Committee in favor of 1883 was approved. The Board has invited the governors and mayors throughout the country to send delegates or commissioners to a great national convention, with reference to the fair, to be held June 18 next.

Dew.

Mr. George Dines, who has made extensive experiments and observations on the formation of dew, finds that the depth of deposit in England in an evening rarely exceeds a hundredth part of an inch; and that the average annual depth of the dew deposited upon the surface of the earth does not exceed an inch and a half.



HUNTER'S CLUTCH PULLEY.

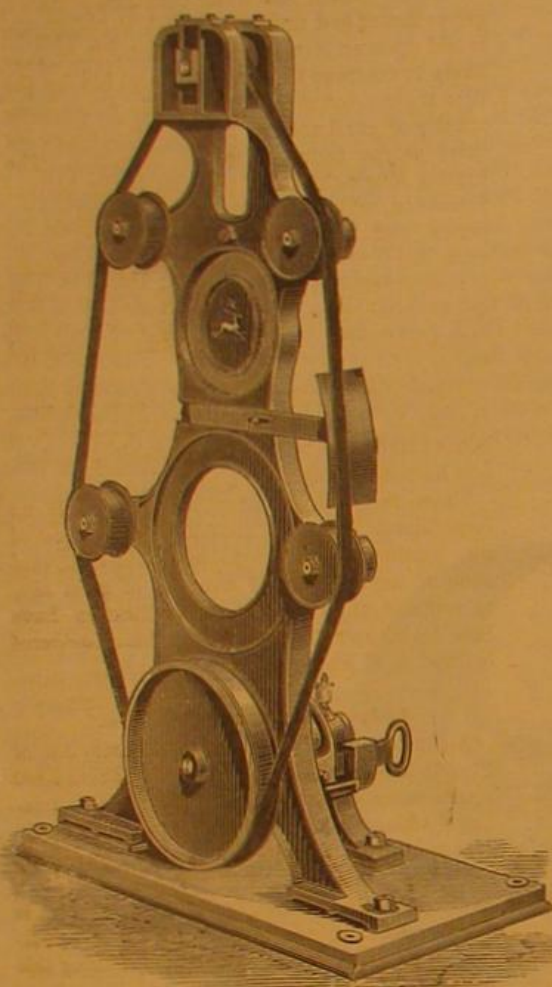
house had been erected at that distance from the stamping presses. Instead of being carried underground, as in the pneumatic dispatch system, the tube was in this case carried over the roofs of the coining rooms, and, descending therefrom, was attached to the great vacuum chamber.

The vacuum chamber had existed from the period of the erection of the mint, and was originally devised by Messrs. Boulton & Watt, the well known engineers of Soho. They had supplied a steam engine of ten horse power, and two single-acting air pumps, each of which discharged air only in its downward stroke, for exhausting the chamber. This cumbersome and comparatively costly, though for its day very ingenious and valuable arrangement, was set aside when the new air-pump came into use. It had performed its mission, and was henceforth to be reserved as a duplicate in the event of the derangement, by accident or otherwise, of its modern supplanter. A regulating, or relief valve, and a barometer gauge fitted to the vacuum chamber, enabled the attendant to control and adjust the extent of rarefaction within the latter.

It will now be comprehended that at all times when the engine and pump are in action a vacuum of more or less extent must exist in the chamber. The chamber, it may be explained, moreover, is a horizontal tube of iron about fifty feet long, and two feet six inches in diameter. It runs along the floor of the mint pump room, in a line parallel to that in which the eight coining presses stand. Arranged along the top of the vacuum chamber, and supported by pipes opening into it, are a series of eight cylinders. These are vertical, and fitted with pistons, the rods from which are connected by levers and cranks with the presses. The cylinders are open-topped, and consequently their pistons are exposed to the pressure of the atmosphere once a vacuum exists below them. This is the case when the pneumatic valves within the cylinders are open to the vacuum chamber. The air within the cylinders then rushes down to the exhausted tube, the atmospheric column drives the pistons after it to the bottom of the cylinders, and the pistons drag with them the central screws of the coining presses. The instant that the beautifully engraved dies are thus made to come into contact with the disks of gold the latter receive by the force of

EMERY BAND POLISHING MACHINE.

There are many things which cannot be very well polished by means of grindstones, emery wheels, or any rigid tools in common use. Polishing by hand must be resorted to in the finish of many articles, in which that part of manufacture is the more costly. We need not mention any of the many purely ornamental articles to find illustrations of this. Most of the brass fittings for boilers have corners and compound curves, difficult to polish and sometimes impossible to get at with any ordinary wheel, or even an annular emery or polishing wheel. For work of this kind, the machine we illustrate herewith seems to recommend itself. It will be seen to consist chiefly of a standard provided with bearings, carrying a driven pulley, over which runs an emery band, which is also carried by five loose rollers, the upper one of which is supported in a movable bearing acted upon by spiral springs to keep the belt tight.

**EMERY BAND POLISHING MACHINE.**

The bands used are endless, and usually of leather covered with emery of a number suitable to the work to be done. Some bands are of tape specially prepared for the purpose. The emery coating is easily renewed by the user. The machine is made by Slack's Emery Wheel and Machine Company, Manchester, and seems to be generally applicable for polishing irregular and curved forms.—*Engineer.*

A NEW ANTI-FRICTION JOURNAL BEARING.

The accompanying engraving shows a novel anti-friction journal bearing which was first publicly introduced at the American Institute Fair, in this city, last fall, where a balance wheel, six feet in diameter, weighing 1,755 lbs., and provided with this ingenious mechanism, was run by a single thread of No. 40 spool cotton, instead of a leather belt. Since then the patentees have exhibited their invention upon railroad cars, wagons, machinery of various kinds, and, in fact, wherever there is circular motion. Upon railroad cars the decrease of friction is said to be so great that a single locomotive can draw a train of loaded cars, equipped with these bearings, as easily as it could draw the same number of empty cars provided with the ordinary journal bearings.

The device also effects a great saving of expense from the fact that it is operated entirely without lubricants, in fact they would only be a hindrance to it; and it is said that "hot boxes" are impossible where the device is employed. The officers of a single line of railroad recently stated that they had to deal with the annoyance of three thousand hot boxes in a single month.

The same difficulty is experienced more or less on ocean steamships and yachts, in mills and factories, and in fact, everywhere where there

is rotary motion. This device was invented by Mr. William Tucker, patented by Messrs. Tucker & Avery, and is manufactured by Mr. John G. Avery, of East Brookfield, Mass. We are told that the invention proceeded from a suggestion made by the *SCIENTIFIC AMERICAN*, some months since, in which we set forth the desirability of a device of this kind. The invention, which is shown in Figs. 1, 2, and 3, comprises a shell, *b*, containing hardened steel rolls, *a*, a journal, *A*, of hardened steel, revolving upon these rolls, and the whole working in a box, *B*, lined with hardened steel. The shell contains sixty rolls, no two of which are in line with each other, and as the journal revolves entirely upon these rolls, friction is decreased to the minimum, and no lubricants are required. The box and journal, also being of hardened steel, are very durable, and will far outlast those equipped in any other way. Rolls are also set in the end of the journal, thus decreasing the friction at that point.

We are informed that this bearing has been in constant use on a road wagon without lubricants, without showing any wear; also that a hand car on one of the principal railroads has been used eight months with the same result, and one of the Boston street railways has a car fitted with the journal that has run over 5,000 miles without appreciable wear. Mr. Avery has successfully applied the principle to engine slides and other sliding surfaces.

MISCELLANEOUS INVENTIONS.

An improved process of inlaying metallic ornaments in wood or stone has been patented by Mr. L. A. Amouroux, of West Mount Vernon, N. Y. It consists in working the alloy in a hot or melted state into engraved or indented portions of the surface to be ornamented, and afterward polishing all together.

Mr. Lyman R. Dexter, of Lancaster, N. H., has patented an improvement in sleds, which consists in a novel clamp for securing the runner to the upright. This device is an improvement on a clamp for which the same inventor received a patent in 1869.

An improved safe or vault, provided with air and water tight chambers entirely surrounding it, has been patented by Mr. Samuel A. Wilkins, of Victoria, Texas. The chambers are arranged so that they may be filled with water from the exterior of a building. The inventor also provides an ingenious burglar alarm.

Mr. John B. Belcher, of Charlotte, Mich., has patented an improved strap for rubber boots, which consists of a rigid ring connected with the boot leg by a strap. The inventor claims that the strap is stronger and more convenient than the ordinary ones.

Mr. G. G. Wright, of Winchester, Conn., has devised an improved rotary engine, having several novel features, which cannot be clearly described without an engraving. The object of the invention is to render the parts simple and accessible.

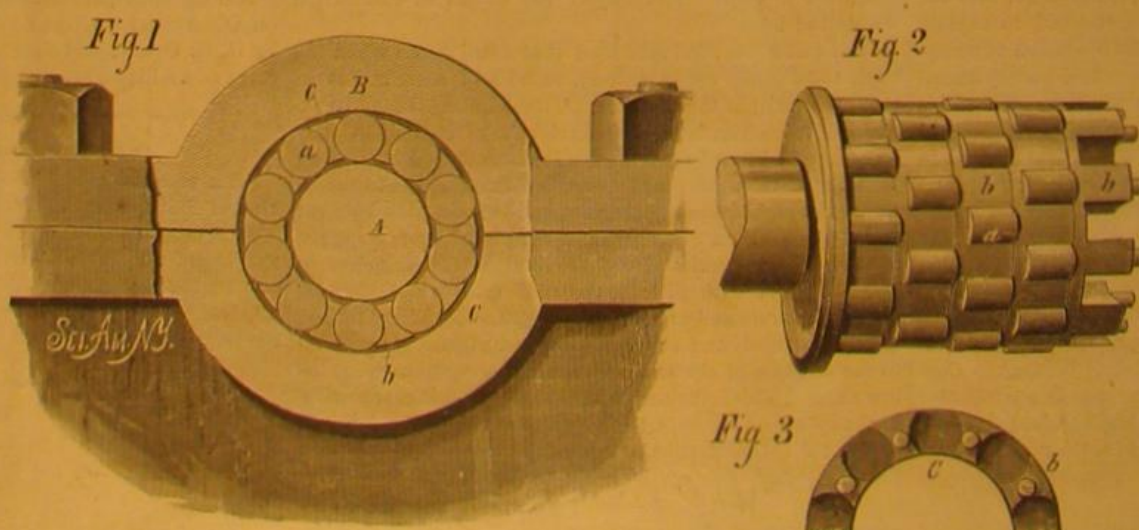
An evaporating pan having a corrugated bottom stamped from a single piece of sheet metal, the corrugations of which extend alternately from opposite sides, so as to form a tortuous passage for the liquid, has been patented by Mr. John L. Bleeker, of Cincinnati, O.

An improvement in riding saddles has been patented by Mr. William M. Herring, of Spring Hill, Texas. The pommel has a hollow neck, and is formed in one piece with the fork and web, and wooden filling pieces are provided, which complete the tree.

Mr. William H. Fix, of Moffatt's Creek, Va., has patented an improvement in axes, the object of which is to adapt the broad ax or hand ax for use by either a right or left handed person. The ax head is pivoted to the handle, so as to rotate in the plane of the axis of the handle.

An improved cover for the steps of wagons, carriages, and other vehicles for preventing the slipping of the feet in wet, muddy, and snowy weather, has been patented by Mr. William Mellon, of Philadelphia, Pa.

A runner stone—provided with a ventilating channel cut diametrically across the face, and having its bottom beveled upon opposite sides of the eye, away from the direction of the rotation of the stone—has been patented by Mr. George Helfert, of New York city.

**AVERY'S ANTI-FRICTION JOURNAL BEARING.****AN IMPROVED WATER ELEVATOR.**

The water elevator shown in the accompanying engraving is the invention of Mr. A. W. Coates, of Alliance, Ohio. It consists, as will be seen from the engraving, of a cylinder, *A*, which is wholly or partly submerged in the water of the well. A weighted piston, *B*, is fitted to the cylinder, and connected with a lever or handle, *D*, fulcrumed in a stand on the well platform. The cylinder is provided with valve covered apertures in the bottom, and also with a delivery pipe, *C*, having a check valve at its lower end. The piston is provided with a downwardly opening valve held up by a spring. This valve allows any water that may escape

**A. W. COATES & CO.'S WATER ELEVATOR.**

through the packing of the piston to return to the interior of the cylinder.

The pump is operated by depressing the handle so as to raise the weighted piston; the handle is then released, when the descent of the piston by its own gravity forces the water up the delivery pipe. The quantity of water raised may be measured by restricting the movement of the handle by means of the pins in the standard near the end of the handle. These pins also serve to hold the piston in an elevated position, so that all that need be done to raise a quantity of water is to release the handle from the pin which retains it.

Further information in regard to this invention may be obtained from Messrs. A. W. Coates & Co., of Alliance, O.

The South African Cable.

The telegraphic cable to connect the European and Asiatic telegraphic systems with Cape of Good Hope will be 4,000 miles long, extending from the Red Sea cable, at Aden, around Cape Guardafui and along the east coast of Africa to

Port Natal, where it will make a junction with the present land line to Cape Town. The cable will be laid along the coast, the depth being moderate along that side of the continent, and the facility for repairing possible breakages has been carefully ascertained. The cable will touch at Zanzibar, Mozambique, Sofala, Delagoa Bay, and thence to Durban as the submarine terminus, from which point the land telegraph becomes available to complete the circuit to Cape Town. The cost of constructing and laying the cable is estimated at \$7,500,000. The line from Durban to Zanzibar is to be finished in July, and the whole cable by the middle of November.

REMARKABLE ACCIDENT TO A RED DEER.

The accompanying engravings represent a curious mishap to one of the red deer in Windsor Park, the following account of which is given by Mr. Frank Buckland, in *Land and Water*:

On the 16th of January last, one of the keepers who has charge of the deer in the royal domains was going his rounds, when he suddenly came upon the scene as represented in Fig. 1. A magnificent red deer was lying on his back, with his leg tightly fixed in the forked branch of a white-thorn tree. This unfortunate animal was lying on his near or left side, with the tip of his right shoulder resting against the trunk of the tree. The chest and fore part of his body were clear of the ground, suspended by his right or off foot in the fork of the tree. Immediate examination showed the keeper exactly what we see in the engraving, Fig. 2, except that the body of the animal (in the engraving) is no longer attached to the foot. The keeper attempted to remove the foot, but found it so tightly fixed that with all his force he was quite unable to do so. The shank bone of the stag's foot was fractured and splintered diagonally. The fractured bones had made their exit by a cut through the skin, thus causing a compound comminuted fracture. The portion of the bone below this fracture—tough and strong as the red deer's shanks are—was shattered into minute fragments the size of dice. The bone was again fractured at its lower part, and the thick skin entirely lacerated through. The large sinews at the back of the bone, as well as the wire-like sinews that work the toes of the foot, were elongated and pulled out, and in fact everything was broken right off except two very slender sinews and a small portion of the skin. The total length of the portion of the deer's leg caught in the tree is seventeen inches; from the fracture to where it was torn off, eight inches. The leg was caught by the branches of the tree about four feet from the ground, and the lowest boughs carrying leaves were about nine feet from the ground. The deer was dead, and it is not known how long he had been held a prisoner by his foot.

As there were no eye witnesses as to how this occurred to the stag, it becomes somewhat difficult to account for this extraordinary event. It is probable, however, that in consequence of the weather the animal was short of food, and that in his wanderings he had observed above his head something edible on the lower branches of the thorn tree, possibly leaves, moss, or lichens, on which deer feed in snowy weather. These he could not reach when standing on all fours. He, therefore, probably raised himself upon his hind legs, and when stretching himself upward and forward, the hoofs of his hind legs slipped from under him, or else, when letting himself down again, his right leg slipped suddenly between the forked branches of the tree, and was instantly held there tight. The animal then probably began immediately to struggle, but the more he kicked and fought the tighter the wrist of his foot got wedged in; in fact, when the preparation was brought to me the foot was so tightly fixed into the notch of the tree that it could not have been more jammed if it had been hammered down, and then a long screw passed through it. In his struggles to get loose the first thing that happened was the fracture of the leg bone. This allowed the animal to fall on his back, from which position, of course, he could not rise. Terribly alarmed at what had happened to him, the poor stag then began to pull and tug at his captive leg, assisting himself so to do by means of his horns. In his frantic exertions to get free, the stag a second time broke his leg, then the skin gave way, and lastly, the large tendons. If his strength had lasted long enough to have ruptured the two small tendons it is possible that he might have escaped, leaving his leg in the fork of the tree. Prince Christian, having been informed of the accident, judiciously ordered the portion of the tree which held the foot to be sawn off bodily. He then kindly sent the whole thing

to me, with a request that the foot should be preserved for him without being removed from the fork in which it had been so tightly jammed by the animal itself.

The preparation will be the most unique specimen of an accident that ever occurred in the royal forest in the annals of English history.

Coral.

The popular idea that coral is formed by an insect busily working to build up reefs in the ocean, is erroneous. A

the sea bottom by one end, while the other spreads. Then a mouth, stomach, tentacles, and corporeal partitions are soon formed, and the last become quite hard from accumulations of particles of lime.

Coral animals belong to the class familiarly called polyps, and they multiply themselves by eggs and also by budding, until there are countless numbers living together in one community. Different kinds of coral bud in different ways; as some grow in bunches, others in round masses, and so forth. A piece of dead coral shows the spot where every animal has lived. As a mass of coral grows, the lower creatures gradually die, but their hard skeletons, consisting mainly of carbonate of lime, remain and furnish a firm foundation for those that work above them. By the striking of the waves against this foundation, its interstices gradually become filled with mud, bits of shells, and other substances which sea water contains, so that it grows firmer and firmer. If such a foundation is laid upon an elevation of the ocean floor, it is likely to continue to increase in size; but by the time it has reached the sea-level, the whole community of coral animals has become lifeless, for these polyps cannot live out of water. The beating billows break off portions of the skeleton formation, which are soon worn into sand by the water, and afterwards, perhaps, thrown with other debris upon the surface of the mass, which is thus supplied with soil. Then perhaps seeds are scattered upon this soil, which give rise to vegetation, and so a pleasant home is prepared for man.

These coral structures, called reefs, are often circular in form, and many of them inclose a lake or lagoon, whose waters furnish an excellent harbor for ships.

These reef-builders have not only built up large islands, but also considerable portions of the continents of Europe and America; and some of their structures must be of great age, as remains of a prehistoric civilization have been found upon them.—From a lecture delivered by Prof. B. F. Mudge in *Science Observer*.

Industrial Uses of Bamboo.

A late report of Dr. Schlich, Conservator of Forests in Bengal, says that there are about 1,800 square miles of pure bamboo forests in the Arrakan division of British Burmah, within a moderate distance of the coast, and all accessible by navigable streams. All these bamboos have flowered several years ago, and the ground is now covered with seedlings, which make the forest impassable. The question as to the practicability of using this plant for purposes of paper-making has several times been raised by Mr. Thomas Routledge, of England, and he has very recently returned to the charge again in a pamphlet entitled "Bamboo and its Treatment," wherein he has brought together information from botanists and cultivators well worthy of serious attention. From the *Lumberman's Gazette* we learn that a company has been formed in England, with a large capital, for the extensive and various utilization of this plant in the arts of industry, the enterprise having its origin in the multitude of uses for which the material is and for so long a time past has been employed in India. Besides being used in the latter country in the construction

of the implements of weaving, Bamboo is there utilized for almost every conceivable purpose for which wood is resorted to in other countries. It forms the posts and the frames of the roofs of huts; scaffolding for building houses; raised floors for storing produce, in order to preserve it from damp; platforms for merchandise in warehouses and shops; stakes for nets in rivers; bars, over which nets are spread to dry; the masts, yards, oars, spars, and decks of boats. It is used in the construction of bridges across creeks; for fences; as a levee for raising water for irrigation. It is the material of which several agricultural implements are made, as the harrow, the handles of hoes, clod breakers, etc.; hackeries or carts, doodles or litters, and biers are all made of it; and a common mode of



Fig. 2.—FORE LEG OF THE STAG CAUGHT BY FORKED BRANCHES.

piece of coral is composed of the skeletons of tiny animals that in life are covered with a gelatinous substance. More than a thousand species of the coral animal have been described by Dana in his work entitled "Corals and the Coral Islands."

Of the sub-kingdoms into which the animal kingdom is divided, namely, vertebrates, articulates, mollusks, radiates, and protozoans, coral animals belong to the radiate division. These creatures have no sense except a low degree of sensitiveness, and live in salt, clear water, having a temperature of from 68° to 85° Fah. They do not live singly, but grow together in clusters, which start from a single, little animal, that is soft, oval, white, and jelly-like, and has the power of rapid motion. It attaches itself either to a rock or



Fig. 1.—ACCIDENT TO A STAG IN WINDSOR PARK.

carrying light goods is to suspend them from the end of a piece of split bamboo laid across the shoulder. Further, a joint of this material serves as a holder of many articles, as pens, small instruments, and tools, and as a case in which little articles are sent to a distance: a joint of it also answers for the purpose of a bottle, and is used for holding milk, oil, and various fluids, a section of it constituting the measure for liquids, in bazaars. A piece of it, of small diameter, is used for a blowpipe to kindle the fire, and by gold and silver smiths in melting metals. It also supplies the place of a tube in distilling apparatus. These, of course, comprise but a portion of the uses to which this valuable material is applicable, and it opens up a wide field for manufacturing industries.

NEW AGRICULTURAL INVENTIONS.

A gang plow in which the tongue and axle frame are combined with a pair of plow beams, connected adjustably at the rear end and pivoted to the tongue in front, so that it may be readily operated, has been patented by Mr. L. M. Kelly, of Litchfield, Ky.

An improved cultivator fender, which may be used with either a one horse or two horse cultivator, has been patented by Mr. Andrew Simmons, of Green Vale, and Michael Simmons, of Lena, Ill. It is designed to prevent the earth from being thrown upon the plants by the cultivator plows.

Mr. R. D. Norton, of New Sharon, N. J., has patented an improved pulverizing disk harrow, in which some of the details of the machine are perfected so that it is rendered more durable and effective.

An improved machine for the distribution of liquid or powdered poison upon cotton or other plants has been patented by Mr. Thomas B. Taylor, of Mount Meigs, Ala. It consists mainly in a perforated cylinder mounted on bearings supported by a plow beam, and capable of turning so as to sift or sprinkle the poison on the plants.

Ozone in Relation to Health and Disease.

Henry Day, M.D., in an address delivered before the Congress of the Sanitary Institute of Great Britain, gives the history of the discovery of ozone, and notices the successive theories of Schönbein, Williams, and Odling concerning its nature. He then describes the pathological action of this form of oxygen, and reveals facts which will probably startle those who believe ozone and "ozoneized" articles of food or of medicine to be universally beneficial. He describes the death of animals after exposure to ozone under symptoms closely resembling those of acute bronchitis. He considers that if present in excess in the atmosphere, catarrh, bronchitis, and even pneumonia would be its natural results. Whether there is ever such an excess as would involve these consequences is an open question. He feels also bound to admit, according to the researches of Dr. Moffat, that during "ozone periods," apoplexy, epilepsy, vertigo, neuralgia, and diarrhea are more frequent. Further investigations in this direction are imperatively needed, but what has been said may serve as a caution to dabblers in science who keep an ozone apparatus in action in their sitting-rooms as a prophylactic against diseases in general.

The absence or the deficiency of ozone has been, perhaps, too hastily placed in connection with zymotic disease. But that such a connection exists in case of cholera can scarcely be doubted. The author shows that in 1864, in the Bombay Presidency, cholera was in its greatest ascendancy when ozone was either wanting or at its minimum; that the disease showed a most marked decrease when ozone was registered as increasing, and when at its maximum the epidemic ceased altogether if the maximum continued for any time. Similar results were obtained at Strassburg in 1854 and 1855, and the experiments of Mr. Glaisher and of Dr. Moffat give confirmatory testimony. Whether there may be other causes in operation in addition to deficiency of oxygen is still doubtful. As a disinfectant the author pronounces it the best, safest, and least objectionable known. That it may kill disease germs—whatever they may be—is no doubt highly probable from its action on the superior animals; but the question arises, pertinently says the *Chemical News*, Which will be killed first? and adds, We are somewhat surprised at finding in this address no reference to the well known and justly admired work of Dr. C. B. Fox.

Varying Velocity of Sound.

Some interesting experiments have been made at the U. S. Arsenal at Watertown, Mass., to determine whether the velocity of sonorous waves is or is not affected by variations in intensity and pitch. A 6 lb. brass field piece was placed in the midst of a large level field, and behind it, at distances ranging from 10 feet up to 110 feet, were placed a series of membranes electrically connected with a chronograph, which would thus give the instant at which the sound wave from the gun met each membrane in succession. The experiment was repeated many times and always with the same result. It was found that immediately in the rear of the cannon the velocity of sound was less than at a distance, but that going further and further from the cannon the velocity rose to a maximum considerably above the ordinary velocity, and then fell gradually to about the ordinary. When the gun, however, was pointed at right angles to its first position it was found that the position of maximum velocity was brought nearer to the cannon, and if the gun had been turned in the direction of the line of membranes, which was impracticable, it is thought the retardation which produced the first low velocities would probably have become an acceleration.

The heaviest charges of powder caused the greatest deviations from the ordinary velocity. The experiments, accordingly, prove that the velocity of sound depends to some extent on its intensity, and that experiments on the velocity of sound in which a cannon is used contain an error, probably due to the bodily motion of the air near the cannon. Evidently a musical sound of low intensity must be used for a correct determination of the velocity of sound.

JAPANESE MIRRORS.

Mr. R. W. Atkinson, of the University of Tokio, Japan, communicates to *Nature* the following interesting account of these curious mirrors:

A short time ago a friend showed me a curious effect, which I had previously heard of, but had never seen. The ladies of Japan use, in making their toilet, a small round mirror about 1-12 to 1-8 inch in thickness, made of a kind of speculum metal, brightly polished and coated with mercury. At the back there are usually various devices, Japanese or Chinese written characters, badges, etc., standing out in strong relief, and brightly polished like the front surface. Now, if the direct rays of the sun are allowed to fall upon the front of the mirror, and are then reflected on to a screen, in a great many cases, though not in all, the figures at the back will appear to shine through the substance of the mirror as bright lines upon a moderately bright ground.

I have since tried several mirrors as sold in the shops, and in most cases the appearance described has been observed with more less distinctness.

I have been unable to find a satisfactory explanation of this fact, but on considering the mode of manufacture I was led to suppose that the pressure to which the mirror was subjected during polishing, and which is greatest on the parts in relief, was concerned in the production of the figures. On putting this to the test by rubbing the back of the



JAPANESE MAGIC MIRROR.

mirror with a blunt pointed instrument, and permitting the rays of the sun to be reflected from the front surface, a bright line appeared in the image corresponding to the position of the part rubbed. This experiment is quite easy to repeat; a scratch with a knife or with any other hard body is sufficient. It would seem as if the pressure upon the back during polishing caused some change in the reflecting surface corresponding to the raised parts whereby the amount of light reflected was greater; or supposing that, of the light which falls upon the surface, a part is absorbed and the rest reflected, those parts corresponding to the raised portions on the back are altered by the pressure in such a way that less is absorbed, and therefore a bright image appears. This, of course, is not an explanation of the phenomenon, but I put it forward as perhaps indicating the direction in which a true explanation may be looked for.

The following account of the manufacture of the Japanese mirrors is taken from a paper by Dr. Geerts, read before the Asiatic Society of Japan, and appearing in their *Transactions* for 1875-76, p. 39:

"For preparing the mould, which consists of two halves, put together with their concave surfaces, the workman first powders a kind of rough plastic clay, and mixes this with levigated powder of a blackish 'tuff-stone' and a little charcoal powder and water, till the paste is plastic and suitable for being moulded. It is then roughly formed by the aid of a wooden frame into square or round cakes; the surface of the latter is covered with a levigated half-liquid mixture of powdered 'chamotte' (old crucibles which have served for melting bronze or copper) and water. Thus well prepared, the blackish paste in the frame receives the concave designs by the aid of woodcuts, cut in relief. The two halves of the mould are put together in the frame and dried. Several of these flat moulds are then placed in a melting box

made of clay and 'chamotte.' This box has on the top an opening into which the liquid bronze is poured, after it has been melted in small fireproof clay crucibles. The liquid metal naturally fills all openings inside the box, and consequently also the cavities of the moulds. For mirrors of first quality the following metal mixture is used in one of the largest mirror foundries in Kioto:

Lead.....	5 parts.
Tin.....	15 "
Copper.....	80 "
	100

For mirrors of inferior quality are taken:

Lead.....	10 parts.
Natural sulphide of lead and antimony....	10 "
Copper.....	80 "
	100

"After being cooled the melting box and moulds are crushed and the mirrors taken away. These are then cut, scoured, and filed until the mirror is roughly finished. They are then first polished with a polishing powder called *to-no-ki*, which consists of the levigated powder of a soft kind of whetstone (*to-ishi*) found in Yamato and many other places. Secondly, the mirrors are polished with a piece of charcoal and water, the charcoal of the wood, *ho-no-ki* (*Magnolia hypoleuca*) being preferred as the best for the purpose. When the surface of the mirror is well polished it is covered with a layer of mercury amalgam, consisting of quicksilver, tin, and a little lead. The amalgam is rubbed vigorously with a piece of soft leather, which manipulation must be continued for a long time until the excess of mercury is expelled and the mirror has got a fine, bright, reflecting surface."

Professors Ayrton and Perry give the following explanation of the phenomena of the Japanese mirror:

"The magic of this Eastern mirror arises not, as has been supposed, from a subtle trick on the part of the maker, nor from inlaying of other metals, nor from hardening of portions by stamping, but from the natural property possessed by certain thin bronze of buckling under a bending stress so as to remain strained in the opposite direction after the stress is removed. And this stress is applied partly by the *megebo*, or 'distorting rod,' and partly by the subsequent polishing, which in an exactly similar way tends to make the thinner parts more convex than the thicker."

Lifting a Railway Bridge without Stopping Traffic.

A dispatch from Easton, Pa., dated April 10, states that the cleverest feat of engineering ever attempted in that region has just been successfully carried out. It seems that, owing to their immense weight, the iron shoes, in which rest two of the spans of the long bridge of the Lehigh Valley Railroad, had sunk about an inch, throwing the bridge out of grade. The inside masonry of the pier being less solid than the outer casing, it was evident that the depression would continue; accordingly an iron casting, 12 feet long, 3 feet 3 inches wide, and 3 inches thick, and weighing 7,000 pounds, was placed under the spans to elevate them, the spans being raised for that purpose by hydraulic jacks. The spans weigh 180 tons each. The spans were raised, the masonry redressed, the castings placed in position, and the spans lowered, without the stoppage of a single train.

A Large Steel Bridge.

The five span steel railway bridge over the Missouri River at Glasgow, Mo., is the first large bridge in this country built entirely of steel—from nuts to girders. The American Bridge Company built it of steel manufactured by the Edgar Thompson Bessemer Steel Works, but the steel was made by the A. T. Hay process. This consists of a decarbonizing followed by a recarbonizing of the iron, by which much greater tensile strength and elasticity are secured. This kind of steel allows of the construction of a much lighter bridge than if made of wrought iron, and is not affected by frost or cold weather.

Erratum.

In the description of Messrs. Pew & Weerts' carbureter, in our last issue, there is an obvious error in the statement of the economy of the apparatus. It should read: The gas meter registers one foot per hour for each burner, instead of the usual six feet, or only one hundred and twenty-five feet during five tests of five hours each, as compared with seven hundred and fifty feet, the amount usually consumed.

Importance of Patents Abroad.

The American Consul at Verviers, Belgium, in a dispatch to the Department of State, recommends American inventors to procure patents for their inventions in Europe as well as in the United States; that the drawings in the *SCIENTIFIC AMERICAN* are extensively copied in Europe, and American inventions are thus reproduced with no profit to the inventors.

THE MEXICAN EXHIBITION.—At the end of March 600 mechanics and laborers were engaged on the Exhibition Building, which was making rapid progress. Señors Riva Palacio and Sebastián Camacho are reported to have offered to advance the Government a loan of \$200,000 toward completing the Exhibition Building at an early day.

It is said that the oil that exudes from orange peel when bent between the fingers, will check the progress of carbuncles in their incipient stage. Perhaps the oil may also be useful for other cutaneous eruptions.

CALCAREOUS SPONGES.

This group of sponges received its name from the crystalline calcareous deposits scattered throughout the entire body of the sponge, and forming a skeleton similar to those formed by the silica composing the greater portion of silicious sponges. These calcareous deposits are formed by slender needles arranged in groups of from four to six each around a common center. The sponge possesses a small quantity only of organic tissue, and therefore on drying the sponges retain their original shape and size, and present, whether alive or dead, a chalky appearance.

The most elaborate monograph of calcareous sponges is that of Haeckel, the naturalist, in which he proves beyond doubt that the so-called one hundred and eleven species of calcareous sponges sent to him from all parts of the globe cannot be considered distinct species, but that they possess the capability of adapting themselves in form and structure to the variable conditions presented by different localities. Haeckel has, however, for the sake of convenience, divided these species into several families, the structural differences of which evince a progressive tendency from the simple to the complex. We are acquainted with the successive stages of development of a few species only, and of these the most important one is that of the larvæ.

If a calcareous sponge arrived at maturity, which is generally the case in May, is cut in slices or torn apart in small pieces, the larvæ are liberated and may be observed by means of a good microscope. They consist of two portions, differing greatly in appearance. One of them is composed of long conical cells carrying a long thread each (Figs. 1 and 2). The other consists of a number of round cells, rendered opaque by granular deposits.

Shortly after separating from the mother sponge the larva attaches itself to a rock. The threads attached to the cells of the upper half disappear, and the interior of the conical cells rapidly fills with calcareous crystals penetrating soon to the surface. An aperture is formed, lined by masses of crystals; the sponge grows and hardens gradually. The following spring it sends

Fig. 3.—*Leucandra penicillata*.

forth swarms of larvæ, which are carried to great distances by the sea currents.

The larger quantity of the water necessary for the maintenance of sponge life is alternately drawn in and ejected through pores scattered throughout the superficial crust of the sponge. Of these sponges there are three groups—bag sponges or ascones, bulb sponges or leucones, and honeycomb sponges or sycones. Bag sponges form closed or open cylinders, the walls of which are very thin. They are frequently so small and tender that they are hardly noticeable. Often a number of cylinders are united together, forming agglomerations of the size of the fist. To this family belong the beautiful *Ascella clathrus* found plentifully in the Gulf of Naples and the *Ascella botryoides*, met with in the Northern seas.

The second family is characterized by an excessive development of the calcareous deposits. Among the most common representatives of this family is *Leucandra penicillata*, illustrated in natural size by Fig. 3.

The highest degree of development is attained by the third family. Numerous individuals are united so as to form round disks resembling a honeycomb. The individuals have the shape of an elongated cup, Fig. 4, or a cylinder resting on a short stem. The edge of the cup is lined with a row of long slender needles.

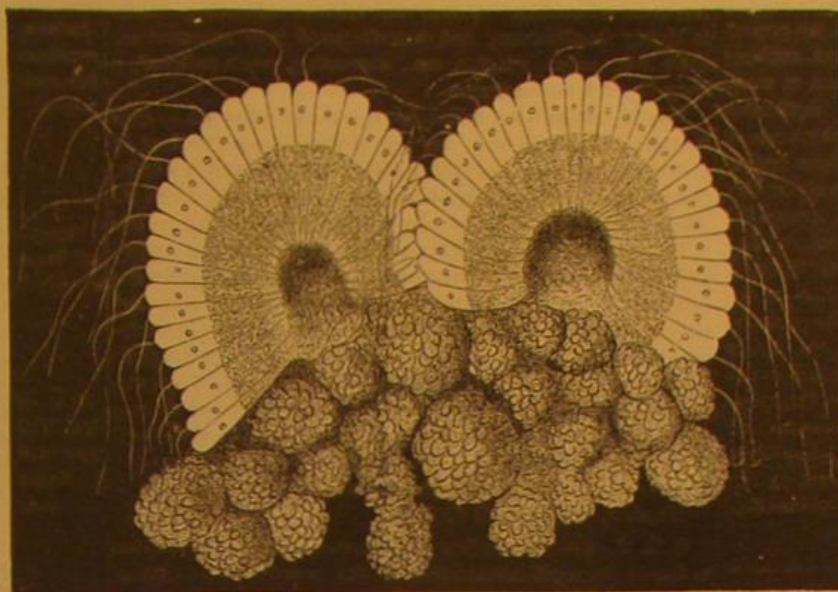
Haeckel speaks as follows of the conditions under which the calcareous sponges pass their semi-animal life:

Calcareous sponges are found only in the sea. Not a single species has so far been found in fresh water or even in the mouths of rivers. Not a single species has been met with in the Baltic, the waters of which are very poor in salt, and this is also the case in the fjords of Norway. Placed in fresh water they die in a short time. Water containing a large percentage of mineral substances in solution seems, therefore, to be indispensable for maintaining the life of calcareous sponges.

Most of the species so far examined have been obtained from considerable depths. To all appearances light is injurious to their development, as the larvæ invariably select dark, shady spots for permanent attachment.

The Fruit of the Rose Bush as a Preserve.

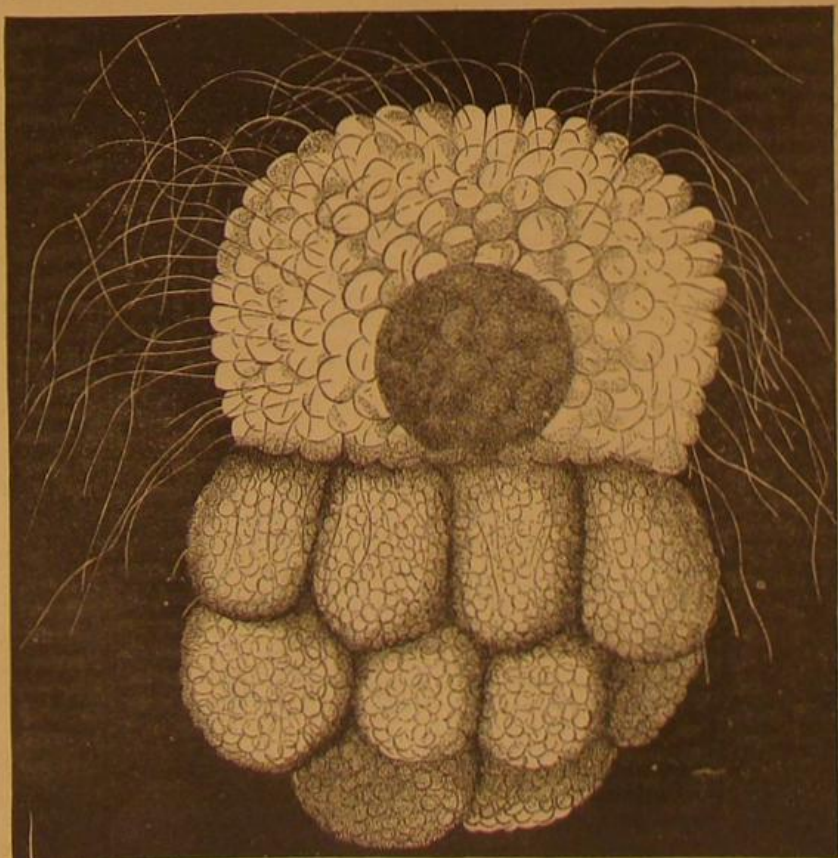
Brillat-Savarin, in his "Physiologie du Gout," says that "the discovery of a new dish does more for the human race than the discovery of a star." If this be true, a writer in one of our French exchanges (*La Maison de Campagne*) has elevated himself above the average astronomer in announcing the discovery that the scarlet fruits of the rose bush, or "rose hips," as they are called, are capable of being made into most delicious preserves. Considering the fact that

Fig. 2.—Transverse section of a twin individual of larva of *Sycondra raphanus*, 1:600.

nearly every genus of the order *Rosaceæ* already furnishes man with delicious fruits, as strawberries, peaches, apples, pears, plums, etc., there is certainly no reason why the rose genus should not do so likewise. The fruit of every rose bush, says this writer, no matter what the species, provided it has single flowers (in other words, provided it is a wild species, for the flowers of the cultivated kinds are usually double), is good for preserving as soon as it has become ripe and tender. The essential point is to gather the fruit at the right moment, which, in the case of the sweetbrier (*Rosa rubiginosa*), would be in September. Gather the fruits, then, as soon as they have become soft, take out their seeds, put them in an earthen or porcelain-lined saucepan, and place them over a slow fire, having added just enough good wine vinegar to make them pass readily through a colander, after five minutes' cooking. Place them over the fire again, and add enough sugar to overcome the acidity of the vinegar, and let them boil again very gently, stirring all the while, until they become of a homogeneous and pasty consistency.

Put this in jars or wide-mouthed bottles, and it will keep indefinitely.

The author adds that preserved rose hips, properly prepared, give an exquisite flavor to sauces, go well with

Fig. 1.—*Sycondra globra*, 1:600.

beef, veal, and chicken, and combine well with truffles and mushrooms; and that a dash of Madeira wine in no wise injures the preserve. Wild rose bushes exist everywhere, by the roadside and in fields, all over the country, and their fruit can be had for the gathering. It only remains for the American housekeeper to take the hint and try the experiment.

The Grape Phylloxera.

[Latest Facts about the Phylloxera: read by C. V. Riley at the recent annual meeting of the Missouri State Horticultural Society.]

The fact that about 280 tons of California grapes were received weekly and sold in the markets of Philadelphia during the past season, is sufficient to show that the grape interest in this country is increasing in importance, and to lead to the hope that the discouragement which the Missouri grape grower naturally feels, after four consecutive unfavorable seasons, must needs soon give way before brighter prospects that, it seems to me, are necessarily in store for him. One thing is sure, namely, that the interest manifested abroad in our American grape vines does not flag. These vines are constantly discussed in the foreign horticultural journals, while one periodical, entitled *La Vigne Americaine* (The American Vine), is entirely devoted to them. It is a source of no little satisfaction to me that the varieties which I first recommended, seven years ago, are in the main those still sought for and used by the French sufferers from phylloxera, as stock on which to graft their *vinifera*. It is further interesting to observe that the grounds which I took in regard to grafting above ground, in my 7th Report, pp. 108-116, are justified by the experience had during the last few years in France. Such grafting is found to be quite practical, notwithstanding the want of faith shown in it by our earlier ampelographers.

I sincerely hope that this question of grafting the vine above ground as a means of evading the injuries of phylloxera, or of improving such varieties as do not succeed upon their own roots, will be discussed by your society, so as to bring out whatever experience on the subject the Missouri grape growers have had of late. The fears which I expressed in my 7th Report, as to the danger of the introduction and spread of the phylloxera in California, have also been more than justified, since many vineyards have already been seriously injured or totally destroyed by the insect. I am glad to be able to confirm, in this connection, the truth of the statement of Mr. P. J. Birckmans, of Augusta, Ga., namely, that this insect does not occur in that locality. While spending a few days with him last September, I was able to verify its non-occurrence there; and here let me remark that, however much contempt a Missourian may have for the Scuppernon, no one can witness the prolificacy or experience the delicacy and sweetness of such varieties as Tenderpulp and Thomas, as they grow in that region, without having a due appreciation of their value for the Southern States.

Regarding the range of phylloxera, it had often been asserted that around Washington the root insect was not to be found. Yet I have found it extremely abundant, both in the vineyards of the district, and of those just across the line in Virginia, some of the latter suffering to such an extent that the crop was a failure, though the owners were unsuspecting of the cause.

After reviewing, in my 8th Report, all that was then known of the habits and natural history of the grape phylloxera, I drew certain practical conclusions, to the effect that complete knowledge of its habits, instead of simplifying its destruction, showed that it was almost if not quite hopeless to expect its destruction by any possible or practical means, and rendered preventive measures all the more urgent. I expressed my doubt as to the value of decortication of the vines, and the burning of the bark in winter, or by any means which aimed at the killing of the winter egg upon the branches and canes of the vine. Diligent search has failed to reveal these winter eggs in anything like the quantity one might expect, and the fact remained that the insect could go on propagating under ground for at least four years without the necessary intervention of the impregnated egg. Further researches, made since, confirm me in the belief that the normal mode of hibernation of the species is as a young larva upon the roots. From the results of the deliberations of the International Phylloxera Congress, held last summer at Lausanne, and that held at Montpellier, in France, it was conclusively proved that decortication, as I had anticipated, was of little or no avail.

Before leaving the question of phylloxera, let me briefly refer to certain theories first propounded by Prof. A. C. Cook, and that have been extensively promulgated during the past two years; as to the relation of phylloxera and grape-rot. I took occasion, last spring, to protest, in the *New York Tribune*, against the supposed connection between the two, and it will not be out of place to repeat the reasons: "Already, in 1871, when I first announced the presence of phylloxera on the roots of American vines, and explained

Fig. 4.—*Sycondra ciliata*.

the injury which it caused, there were writers who, not content with the simple facts, went much further and asserted that this little insect must also be the cause of mildew, rot, etc. Professor Cook has jumped to similar false conclusions, and has, during the present winter, promulgated before various societies his belief that the phylloxera is the cause of black rot in grapes. This is sensation, not science, and it is to be deplored, coming from the source it does. The phylloxera occurs in most grape-growing sections of the country east of the Rocky Mountains, and will quite naturally be found on vines on which the fruit has rotted.

"But an experience covering several years, and the examination of hundreds of vines, with rot of fruit and without it, enables me to deny the assertion that the insect is more numerous on the former than the latter. The phylloxera disease has its own peculiar characteristics, which are at once distinguished from other vine diseases by those understanding it. There are also very conclusive reasons for discarding the views of Prof. Cook. 1. In France, where the phylloxera has been so very destructive, the black rot has not accompanied or followed it. 2. The rot, so far as I have observed it, is no worse on the susceptible than on the more resistant varieties; while many cases might be adduced of healthy vines, and those least affected with the insect suffering most from rot. 3. On account of three successive wet summers of 1875, 1876, and 1877, in this part of the country (Missouri), the phylloxera has been less numerous and less injurious than at any time since 1871, and many vines that were suffering near to death have recuperated, yet no year since the time mentioned has black rot been worse than it was last summer."

Correspondence.

The Genesis of the Mosquito.

To the Editor of the Scientific American:

For several years past I have noticed in warm weather, that my wooden cistern, which is above ground, has been infested with peculiar looking little red worms. I have heard many others like myself complain of these worms, and I had taken it for granted that they were a species of earth worm. However, last summer I procured a glass jar and sprinkled the bottom of it with a very small quantity of sand and clay. I then half filled the jar with clear fresh water, and, after putting a dozen of these worms in the jar, I tied a piece of cloth over the mouth, and placed it in a light, airy place.

The worms were from half to three fourths of an inch in length, of a bright red color, and had rather a jointed appearance about the body. They would crawl on the bottom of the jar, swim through the water by a rapid bending of the body backward and forward, and occasionally come up to the surface of the water and float.

Within twenty-four hours after placing them in the jar, I noticed that they had all gone down to the bottom of the vessel, and had enveloped themselves separately in a kind of temporary shell made of earth and sand.

In a few days after this I saw one of these worms crawl out of his temporary house at the bottom of the jar, and swim to the surface of the water. Here, after twisting about for a few seconds, he ruptured a thin membrane that enveloped his body, and came out a full fledged mosquito ready for business. I noticed many of the other worms going through the same performance within a short while afterward. Some of the mosquitoes were much larger than others, but, as I have already stated, some of the worms were also larger than others.

F. W. COLEMAN, M.D.

Rodney, Miss., April, 1879.

Remedies for Carpet Beetles, Moths, etc.

To the Editor of the Scientific American:

At this season we are frequently besieged by inquiries in relation to the "carpet beetle," moth, etc. Many of your readers may be glad to know of the following simple remedies:

First.—Steep one quarter of a pound of Cayenne pepper in a gallon of water; add two drachms of strychnia powder. Strain and pour this tea into a shallow vessel, such as a large tinned iron milk pan. Before unrolling a new carpet, set the roll on each end alternately in this poisoned tea for ten minutes, or long enough to insure the saturation of its edges for at least an inch. After beating an old carpet, roll and treat all its seams and edges to the same bath. Let the carpet dry thoroughly before tacking it to the floor, in order to avoid the accidental poisoning of the tacker's fingers by the liquid. It is perhaps unnecessary to state that the residue of the liquid should be thrown out where it will not be drunk by any domestic animal, or if preserved for future use, carefully labeled "poison."

This preparation will not stain or disfigure carpets nor corrode metals in contact with the carpet, as will most preparations of corrosive sublimate.

Second.—One pound of quassia chips, one quarter of a pound of Cayenne pepper steeped in two gallons of water. Strain and use as above. This preparation, although irritating to the human skin, especially on cut surfaces, has the advantage of not being poisonous.

To either of these teas from one quarter to one half more boiling water may be added at the time of first using, if greater depth of the liquid in the vessel be required. When it is desirable to treat carpets that are not to be taken up, either of the above preparations may be applied by means of

any of the common atomizers to every seam and margin with good results, although a second, and even third, application may be needed.

FRANCIS GREGORY SANBORN,
Consulting Naturalist.

Andover, Mass., April 10, 1879.

The Ice Cave of Decorah, Iowa.

To the Editor of the Scientific American:

"H. M. W." is mistaken about the formation of the Upper Iowa Valley, Winneshiek county, Iowa, where the Decorah Ice Cave is situated. It is in the Trenton limestone, which is highly fossiliferous, and manufactured into monuments, table tops, paper weights, etc., presenting, when polished, a very beautiful appearance.

The Ice Cave is a fissure in the Trenton limestone cliff facing to the south, and runs nearly parallel with its face, is about 100 feet long, and varies from 2 to 6 or 8 feet in width. Height irregular, in places compelling progression on hands and knees. Says White's "Geology of Iowa," vol. 1, p. 80: "The formation of the ice is probably due to the rapid evaporation of the moisture of the earth and rocks, caused by the heat of the summer sun upon the outer wall of the fissure and the valley side. This outer wall is from 10 to 20 feet in thickness where the ice is most abundant. The water for its production seems to be supplied by slow exudation from the inner wall of the cave." It forms the most rapidly during the extreme heat of summer, and disappears in winter entirely. From several years' acquaintance with the cave, I believe the above explanation correct.

A. M. M.

Waukon, Iowa, April 2, 1879.

C. B. A. submits another explanation, namely, that the ice is due to the rapid evaporation of the moisture percolating through the soil and rocks above. To produce the ice "two conditions are necessary: first, that the supply of moisture in the cave must not be (as it was when I visited it, a hot day in June, after much rain) great enough to warm the cave and thus overcome the cooling tendency of the evaporation to form ice or to melt the ice that may have been previously formed.

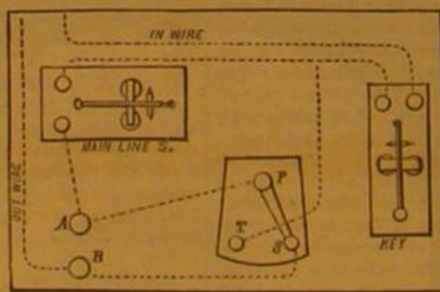
"Second, the supply of water must be sufficient to carry on the evaporation and leave a surplus for conversion into ice. This condition is met only during the summer months, when the temperature is high enough to create a current of air upward through the cave, and when supply of water is not so great as at other seasons. In the winter the ground is frozen and water prevented from soaking through, and so the ice formed in the summer evaporates. Also, the temperature outside and inside being so nearly the same, very little air passes through."

C. G. C. writes that a counterpart of the Decorah Ice Cave occurs on the south side of Black River, at Watertown, N. Y., the rock being the well known Black River limestone.

Telephones and Sounders.

To the Editor of the Scientific American:

As some of your readers appear to find difficulty in using telephones and sounders in the same circuit, I would recommend the following plan, which has been found to work well in practice upon a line where there are twenty offices, and nearly as many telephones in use:



The diagram shows the arrangement. The in wire, which comes from the zinc pole of the battery, is carried to the key and from the key to the relay or main line sounder, and thence to a binding post marked A. B is another binding post, from which the out wire goes to the line. P T S is a two point switch, one point of which, T, is joined to the wire between the key and sounder. P, the point on which the switch tongue turns, is joined by a wire to the post, A, and the point, S, to the post, B. All these connections are beneath the table, the posts, A and B, rising above, and in them the conducting cords of the telephone are inserted. When the switch tongue rests on S the sounder only is in circuit, and can be used to call. When the tongue rests on T the telephone is in circuit, and the sounder is cut out. When the telephone is not in use the switch should be kept on S, closing the circuit through the sounder and preventing waste of battery. Care should be taken that the Z pole of the telephone is attached to the post which receives the zinc wire from the battery, the post, A, in the arrangement as described. If desired, bells may be substituted for sounders.

JOHN E. NORCROSS.

Tracing the Hudson under the Sea.

The Atlantic Coast Pilot, published by the United States Coast Survey, explains the origin of the curious deep holes met with along the New Jersey coast, some distance out at sea. Of these "mudholes," as they are termed, nine are

known to navigators, the deepest and the furthest out being the hundred and forty-five fathom hole, 83 miles southeast of Sandy Hook light vessel. These remarkable depressions, as the Pilot points out, bear the appearance of having been originally a continuation seaward of the Hudson River Valley. They were in all probability scooped out by the river being forced to run through narrow gorges. Several of these gorges can still be traced running almost parallel with the New Jersey shore line. In fact, the soundings along the coast would seem to indicate that the whole coast line, ages ago, was many miles seaward of its position to-day; that then the Hudson River entered the ocean at least a hundred miles southeast of its present mouth, and that the whole continent has since subsided, the sea encroaching further and further inland, as the country gradually sank.

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.

POSITION OF PLANETS FOR MAY, 1879.

Mercury.

On May 1 Mercury rises at 4h. 20m. A.M., and sets at 5h. 6m. P.M. On May 31 Mercury rises at 3h. 40m. A.M., and sets at 5h. 38m. P.M.

Mercury will be best seen near the middle of the month, in the morning, as it is then at its greatest elongation.

Venus.

On May 1 Venus rises at 6h. 45m. A.M., and sets at 9h. 54m. P.M. On May 31 Venus rises at 7h. 21m. A.M., and sets at 10h. 29m. P.M.

The motion of Venus among the stars from night to night is very perceptible. On May 21 it will be 4° south of Pollux in declination, and will precede that star by about 2° in right ascension. Venus and the crescent moon will be nearly in conjunction May 24.

Mars.

On May 1 Mars rises at 2h. 27m. A.M., and sets at 0h. 58m. P.M. On May 31 Mars rises at 1h. 22m. A.M., and sets at 0h. 51m. P.M.

Mars is very distant, but its ruddy color and its nearness to Jupiter on the morning of the 9th will cause it to be easily found.

Jupiter.

Jupiter is coming into a better position. It rises on May 1 at 2h. 35m. A.M., nearly with Mars; and sets at 1h. 25m. P.M. On May 31 Jupiter rises at 48m. after midnight, and sets at 11h. 47m. A.M.

Although Jupiter is in south declination, it is so large a planet that it will be very conspicuous in the early morning. Jupiter will be near the waning moon on the morning of the 14th.

Saturn.

Saturn rises on May 1 at 3h. 57m. A.M., and sets at 4h. 11m. P.M. On May 31 Saturn rises at 2h. 6m. A.M., and sets at 2h. 28m. P. M.

Uranus.

On May 1 Uranus rises at 0h. 47m. P.M., and sets at 2h. 16m. A.M. of the next day. On May 31 Uranus rises at 10h. 51m. A.M., and sets at 18m. after midnight.

Uranus follows the bright star Regulus on May 1 by 2° in right ascension, and is one third of a degree below it in declination. The position changes very little during the month.

Brorsen's Comet.

This small periodical comet has passed its perihelion and is approaching the earth. It resembles a nebulous star, and moves so rapidly by one and another star that with little optical aid the observer can see the change in an hour's watch.

Its motion is from the constellation Camelopardalus to that of Ursa Major. After April 21 the comet is circumpolar and does not set in this latitude. Following the ephemeris of Schulse, the comet will be nearest the earth on May 10. Its place at that time will be among the small stars in the head of the Great Bear.

How to Prevent Diseases among Children.

A correspondent of the New York Times says that he has followed a recommendation from a lady to evaporize a little carbolic acid daily in the heaters as a disinfectant and a preventive against contagious diseases, and the results have been most satisfactory. "I have a large school, and out of the whole number only two pupils have been sick with scarlet fever, and even these cases were indirect ones. In my own family, which consists of fourteen children—fortunately not all my own—and five adults, not one has been afflicted with any malady, not even with a sore throat, for longer than a day or two. We certainly keep the house minutely clean, ventilate it thoroughly every day, and never heat the rooms above 66° Fah. During my thirty years' experience I have never seen the like."

We think it probable that the use of a small quantity of carbolic acid in the manner above mentioned may in some cases be beneficial. But if it were the golden rule in every family to keep the house minutely clean, ventilate it thoroughly every day, and never heat above 66° Fah., there would probably be little need of carbolic acid or any other drug.

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 unequalled 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.

Sutton's Patent Pulley Cover.—If you are losing power get it again by using these covers. Calculate how much power you are losing and find the gain you will make in your work by adopting a positive remedy. Send for a circular. Address Joseph Woodward, proprietor and manufacturer, P. O. Box 3419, New York.

The best results are obtained by the Imp. Eureka Turbine Wheel and Barber's Pat. Pulverizing Mills. Send for descriptive pamphlets to Barber & Son, Allentown, Pa.

Valves and Hydrants, warranted to give perfect satisfaction. Chapman Valve Manuf. Co., Boston, Mass.

Try the new fragrant Vanity Fair Cigarettes, both plain and halves. Most exquisite of all.

Yacht Engines. F.C. & A.E. Rowland, New Haven, Ct.

For Punches, Patent Bending Rolls, Radial Drills, and Angle Iron Shears, Hilles & Jones, Wilmington, Del.

Belcher & Bagnall, 25 Murray St., N.Y., have the most economical Steam Engines, Boilers, Pumps, in market; also improved wood and iron working machinery.

17 and 20 in. Glibed Rest Screw Lathes. Geo. S. Lincoln & Co., Hartford, Conn.

New Pamphlet of "Burnham's Standard Turbine Wheel" sent free by N. F. Burnham, York, Pa.

Vertical Burr Mill. C. K. Bullock, Phila., Pa.

Sheet Metal Presses, Ferracute Co., Bridgeton, N. J.

Excelsior Steel Tube Cleaner, Schuykill Falls, Phila., Pa.

Machine Diamonds, J. Dickinson, 64 Nassau St., N.Y.

Bevins & Co.'s Hydraulic Elevator. Great power, simplicity, safety, economy, durability. 94 Liberty St., N.Y.

A Cupola works best with forced blast from a Baker Blower. Wilbraham Bros., 2338 Frankford Ave., Phila.

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

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

The Ornamental Penman's, Engraver's, Sign Writer's, and Stonecutter's Pocketbook of Alphabets; 32 plates; 25 cts; mail free. E. & F. N. Spon, 446 Broome St., N.Y.

Linen Hose.—Size: 1 1/2 in., 20c; 2 in., 25c; 2 1/2 in., 30c per foot, subject to large discount. For price lists of all sizes, also rubber lined linen hose, address Eureka Fire Hose Company, No. 13 Barclay St., New York.

If in want of Emery Wheels or Emery Wheel Machinery, write to us for catalogue and prices. Lehigh Valley Emery Wheel Co., Weissport, Pa.

Dead Stroke Power Hammers; cheapest and best for general forging and die work; 500 in use. P. S. Justice, Philadelphia, Pa.

Wanted—A New or Good Second-hand Screw Machine. Address Jerome Redding & Co., Boston, Mass.

Doan's Improved Boiler Liquid is gaining many friends from the ranks of skeptics. To try it is to be convinced. A. H. Downer, 11 Peck Slip, New York.

Manufacturers can save 25 per cent of customary outlays by use of H. W. Johns' Asbestos Liquid Paints, which are of a higher grade than any other paints for structural purposes. Samples and price lists sent free by mail. 87 Maiden Lane, New York.

Forsyth & Co., Manchester, N. H., and 213 Centre St., New York. Specialties.—Bolt Forging Machines, Power Hammers, Combined Hand Fire Engines and Hose Carriages, new and 2d hand machinery. Send stamp for illustrated catalogues, stating just what you want.

Partner Wanted.—See "Enterprise," an Adv. on page 286. Address W. W. Pearce, Cuero, Texas.

Partner Wanted.—A party with limited capital.—Address Des Moines Linsed Oil Works, Des Moines, Iowa.

American Watch Tool Co., Waltham, Mass. Lathes for Optical Instrument Makers.

Electro-Magnetic Engine and Battery complete, in running order, for \$2. Send for circular. Crook, Herring & Co., Cor. Centre and White Sts., New York.

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A First-class Pattern Maker desires a Steady Job. Address J. A. Smith, South Newmarket, N. H.

For Sale—State Rights or Entire Patent of Self-Feeding Oil Stove. J. D. Lane, 1012 Lafayette Ave., B'klyn, N.Y.

I want to buy a few patents (old or new), whole or in part. W. P. Harvey, Port Jackson, Mont. Co., N. Y.

New American Edition of the Catechism, and Hand Book of the Steam Engine; 500 pages; 150 illustrations. Price, by mail, \$1.75. Send for circular. F. Kepply Scientific Book Publisher, Bridgeport, Conn.

For Sale—8 1/2 ft. Boring and Turning Mill; 2 Radial Drills; and 1 Combined Punch and Shear. Hilles & Jones, Wilmington, Del.

Lehigh Valley Emery Wheel Co., Weissport, Pa., will be pleased to send their catalogue on application, and special prices when sizes are given.

Presses, Dies, and Tools for working Sheet Metal, etc. Fruit & other cow tools. Bliss & Williams, B'klyn, N. Y.

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The Lathes, Planers, Drills, and other Tools, new and second-hand, of the Wood & Light Machine Company, Worcester, are being sold out very low by the George Place Machinery Agency, 121 Chambers St., New York.

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Steel Castings true to pattern, of superior strength and durability. Gearing of all kinds. Hydraulic cylinders, crank shafts, cross heads, connecting rods, and machinery castings of every description. For price list and circular, address Chester Steel Castings Company, 407 Liberty St., Philadelphia, Pa.

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Elevators, Freight and Passenger, Shafting, Pulleys, and Hangers. L. S. Graves & Son, Rochester, N. Y.

Machine Cut Brass Gear Wheels for Models, etc. (new list). Models, experimental work, and machine work generally. D. Gilbert & Son, 212 Chester St., Phila., Pa.

Best Turkey Emery in kegs, half kegs, and cans; liberal rates by the ton. Greene, Tweed & Co., 18 Park Place, New York.

Blake's Belt Stnds. The most durable fastening for rubber and leather belts. Greene, Tweed & Co., N. Y.

Holly System of Water Supply and Fire Protection for Cities and Villages. See advertisement in SCIENTIFIC AMERICAN of this week.

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Hydraulic Cylinders, Wheels, and Pinions, Machinery Castings; all kinds; strong and durable; and easily worked. Tensile strength not less than 65,000 lbs. to square in. Pittsburgh Steel Casting Co., Pittsburgh, Pa.

Hand Fire Engines, Lift and Force Pumps, for fire and all other purposes. Address Rumsey & Co., Seneca Falls, N.Y., and 93 Liberty St., N. Y. city, U.S.A.

For Shafts, Pulleys, or Hangers, call and see stock kept at 79 Liberty St., N.Y. Wm. Sellers & Co.

Wm. Sellers & Co., Phila., have introduced a new Injector, worked by a single motion of a lever.

NEW BOOKS AND PUBLICATIONS.

TABELLEN ZUR BESTIMMUNG DER MINERALIEN NACH AUSSEHEN KENNZEICHEN. Herausgegeben von Dr. Albin Weissbach. Leipzig: Arthur Felix.

Contains in clear, concise terms the chemical composition, outward appearance, and other properties necessary for the recognition of about 1,000 minerals, together with such remarks as may be of special interest. Only one feature diminishes the value of the book for practical purposes—the minerals are arranged in groups solely according to the similarity of their outward appearance. To determine a specimen the student must, therefore, select one of the numerous tables and hunt up among its members one the properties and behavior of which will exactly correspond with those of the specimen, at the cost of much time. Had the reverse order been chosen, as by Fresenius in his "Qualitative Chemical Analysis," the practical value of the book would have been much greater. Nevertheless the completeness and conciseness of the work render it valuable as a book of reference to the chemist, miner, and mineralogist.

Notes & Queries

HINTS TO CORRESPONDENTS.

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

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

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

Correspondents whose inquiries do not appear after a reasonable time should repeat them.

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

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

(1) H. C. R. asks: What kind of varnish is used to obtain the fine finish on fish rods, and how is it applied? A. Try a mixture of alcoholic shellac varnish 2 parts, boiled linseed oil 1 part, shake thoroughly before using, and apply with a cloth pad, rubbing the article to which the polish is applied, until the varnish is dry and hard.

(2) H. A. M. asks: Will you inform me if there is any difference between a foot square and a

square foot. A. As surfaces, no. In terms, yes. A "foot square" is a square 12 inches on a side (=144 sq. in.). A "square foot" is 144 sq. in. in any shape.

(3) B. asks: What is the lifting power of street gas per cubic foot? A. The average when petroleum is not employed for "enriching," is about 35 lbs. per 1,000 cubic feet.

(4) "Science" writes: My intention is to learn the engineering profession, but I have a liking to either steamship, locomotive, or steamboat engineering. 1. Which, in your opinion, is the best and most skilled position of the three, and receives the best salary? A. Locomotive engineering offers the best field. 2. What is the salary of locomotive engineers on our Western roads? A. We do not think there is any standard; they differ on different roads and with the kind of train.

(5) A. T. T. asks: Will a crank give the same motion as an eccentric to work the valve on an engine? A. Yes.

(6) R. C. L. asks: How can I obtain a high polish on cattle horns? A. a, scrape the horn carefully; b, smooth with powdered pumice stone and oil; c, polish with rotten stone and oil.

(7) H. S. C. writes: A portable 2 horse power steam engine can be purchased for two hundred dollars or less: in view of this why are not our machinists and steam men awake to the fact that there are hundreds of men waiting for a steam road wagon which we know can be got up for less money than to purchase a horse wagon and appliances? A. Your two horse engine would cost nearer \$400 than \$200. Have you considered the expense of a skilled engineer, the current repairs, the chances and costs of accidents, etc.?

(8) J. D. H. writes: If J. A. F. (43) "Notes and Queries," SCIENTIFIC AMERICAN, March 8, will reduce the blast nozzle to seven eighths inch, he will have all the power he wants.

(9) G. M. D. asks: 1. What is waterglass? A. A variety of glass (silicate of soda or potash) containing excess of the alkaline base, soluble in water. 2. How are agates polished? A. Usually horizontal disks of iron, pewter (or copper), wood, and leather covered with moistened emery of different grades of fineness, sand, rotten stone, or tripoli, and putty powder, respectively.

(10) J. F. & J. H. W. write: We saw in SCIENTIFIC, February 22, an alloy of tin and phosphorus. Is phosphorus a metal, and how is it mixed with tin or copper? A. Phosphorus is non-metallic; it may be forced beneath melted metal by means of a rod of baked clay having a small bell-shaped cavity at the lower end.

(11) J. M. asks if hair can be produced on the face by artificial means, and if so, how. A. See answer No. 40, p. 252, current volume, SCIENTIFIC AMERICAN.

(12) W. C. writes: 1. A train is traveling at a speed of 50 miles an hour. A cannon placed on one of the cars is fired off at a given point in the same direction as the train; the projectile from cannon has same velocity as train. How far will projectile be carried in an hour? A. Add the uniform speed of the train to the range of the projectile. 2. Reverse the cannon and shoot in opposite direction. How far will it carry? A. If the ball leaves the gun at same velocity as train is running it will fall nearly vertically to the ground.

(13) H. C. R. asks: How long has the engine in the United States Mint at Philadelphia been in use? A. The horizontal engine, built under the direction of Franklin Peale, Esq., was erected in 1837, and removed in the end of 1877, after 40 years' service. The "Steeple" engine was erected in 1850, and is still in use.

(14) S. M. D. asks: Is there any process by which iron can be prevented from rusting, when not painted; if so what is it? A. See articles on Professor Barff's process, No. 126, SCIENTIFIC AMERICAN SUPPLEMENT, and pp. 327 and 367, vol. 39, SCIENTIFIC AMERICAN.

(15) V. writes: I propose to lay an inch or one and a half inch iron pipe from this office to another office, 250 feet distant, and the pipe is to lie mostly underground and to be used for a speaking tube. It will have three turns or elbows in it. Could conversation at one end be heard distinctly at the other? A. Yes, if the corners turned are not too sharp. Make the curves of your elbows of large radius, say 12 or 18 inches.

(16) T. D. H. asks: What will set the colors in new calico or gingham that are likely to fade, without injury to the goods? A. The mordant will depend altogether upon the character of the dye or color used on the goods. Many dyes (such as the coal tar or aniline series) become bleached by prolonged exposure to sunlight; as a rule this cannot be remedied.

(17) O. S. W. asks: Is ozone produced during the process of ironing cotton clothing? I have frequently noticed the odor of ozone on going into the kitchen where the girl was ironing. A. Probably not; the odor of hypochlorous acid and of nitrous vapors is often mistaken for ozone.

(18) L. L. W. asks: 1. Why is the present apparatus of log chip and line preferred by navigators to any other mode of ascertaining the speed of a vessel? A. Because of cheapness and simplicity; further, "old salts" understand it. 2. Is there any reason why the telephone should not in time carry the voice across the ocean through the cable? A. The electrical current works so slowly through a long submerged cable as to render the use of a telephone in connection with it impossible.

(19) A. P. S. asks how to polish pearl shell (mother of pearl for umbrella handles). A. a. Smooth it on a common grindstone wet with soap and water. b. Apply powdered pumice stone and water with a buff wheel. c. Finish with rotten stone moistened with sulphuric acid a little diluted with water.

(20) O. W. F. writes: If three men have a shaft to carry which is 12 feet long, and two men was to carry with a lever (and the other man at one end) where will they place the lever so as to carry two third of the shaft? A. Three feet from end of shaft.

(21) E. S. C. writes: My engine is horizontal, 6 inches stroke, 3 inches diameter; what size boat of side wheel pattern will it run with ease; what size of paddle wheels and how many strokes to the minute, when the engine runs at 300 strokes? A. Your engine would probably drive a light skiff about 5 to 6 miles per hour in still water; it would, however, depend much on your b'ier, and whether the engine is geared or works direct on paddle wheel shaft. Paddle wheels about 4 1/2 feet diameter by 15 inches face would suit.

(22) J. R. F. writes: We have a 75 horse high pressure engine which exhausts by way of a Berryman heater up through pipe 30 feet high. We have a hole at the bottom, and the steam condensed is now running to waste. Can I utilize this water by pumping it back into the boilers, or would the grease from the cylinder prevent my using it? A. As the Berryman heater heats all the feed water you require, the gain by returning the condensed water will not be worth the cost.

(23) H. L. V. asks: 1. What is "manifold" paper? A. The white paper is only very fine thin writing paper. The black is soft paper, prepared by being smeared with a composition of grease and plumbago or lampblack; this mixture is allowed to remain on for 12 hours, and the paper then wiped with a piece of wool or cotton waste. Place white paper over black, and write with a blunt point. 2. What was the size and capacity of the Mary Bell, said to have been the largest steamboat on the Mississippi? A. We do not know; will some correspondent at the West inform us? 3. Our canary chews the quill end of such of his feathers as fall out. What does it need? A. Cattle fish. 4. What are some good works on spectrum analysis? A. Spectrum Analysis, by H. E. Roscoe; Spectrum Analysis, by H. Schellen, and Spectrum Analysis, by Professor Redwood, No. 79 SCIENTIFIC AMERICAN SUPPLEMENT.

(24) F. G. writes: In reply to B. S. S., April 12, you say it is known in practice that higher results are obtained by throttling. Do you mean by that that it is advisable in an automatic cut-off engine following far enough to show a terminal pressure of say 17 lbs. absolute, to throttle the steam and allow it to follow enough further to make the average pressure the same in both cases? A. The gain by throttling is greatest when working without expansion or with a fixed expansion. We think there is gain in all cases in carrying a greater pressure in the boiler than is required for the engine.

(25) J. S. P. asks how a soft solder for tin vessels can be made, which is used by heating from the flame of a candle. There is such a solder sold on our streets, which so far has given satisfaction. A. Melt together 2 parts of block tin and 1 part of lead. Take a ladle having a small hole in the bottom, and hold it over a barrel of water, and pour the melted solder into it. As the stream of melted solder is cooled by the water it forms a sort of wire.

(26) C. L. asks: If in a room 50 feet long there is a mirror at one end, will the reflection of an object at the other end of the room appear in size the same as one 50 feet from the observer standing at the mirror, or will it appear the same as one 100 feet from the person? A. To a person standing at the mirror it appears 50 feet away. To a person standing 50 feet from the mirror it would appear to be 100 feet distant.

(27) W. G. H. asks: 1. Can an ice boat run dead ahead of the wind at a speed greater than the velocity of the wind? A. No. 2. Do the Gatling guns when fired at an object send the successive shots to the same point if the aim of the gun is not altered, or do the shots spread or scatter? A. We think they do not scatter.

(28) C. P. T. asks: 1. Is there any back movement in the current of a stream of water in a hose pipe when the stream from any cause is suddenly checked, so as to occasion bursting of the hose? A. Yes. 2. If so, does it extend back to the engine or hydrant throwing the stream? A. Yes. 3. Would the pressure or strain on the hose be less after the stream was closed, or greater than while the stream was in motion? A. Greater.

(29) J. H. asks what kind of oil is the best to use in boilers to keep them free from scales; also the best oil for cylinders; also what effect has tallow and lard oil on piston valve, rods, etc.? What effect has petroleum? A. Mineral oil can be used in boilers. Special cylinder oils are prepared for cylinders, though good mineral oil answers very well when properly applied. Pa e tallow and lard oil can be used without injurious effects.

(30) J. B. M. writes: I have a vertical boiler (30 H. P.) without flues or tubes; it is 10 feet high; the firebox is a shell within a shell, 4 inches between the walls, with 4 apertures equidistant for the escape of smoke and flame some 6 inches below the crown sheet; the firebox is 5 feet high; from the crown sheet upward is the steam chamber or dome; the boiler stands on a cast ring, some 6 inches larger than the boiler; and around the boiler there is a sheet iron jacket, the size of the ring, the entire length of the boiler, fitted close by a cap of same at the top. Now, the questions I wish you to answer are these: 1. I want to put a brick wall in place of the iron jacket. Is it essential that I should run the wall the entire length of boiler, or would it do as well if I were to draw in the wall (say 12 inches above the usual water line in boiler) until the brick touched the boiler, and continue to the top; or had I better keep the wall the same distance from boiler all the way up? A. The latter way would be the best. 2. Could I put in a heater made of ordinary wrought iron piping (say 1 inch diameter), placing it between the wall and boiler, where it would be acted on by the heat of the fire so as to save fuel by it, having the same connected directly to feed pump? A. It would be better to use cast iron pipes. 3. I use strong lime water, and it forms scale. Would not an inch pipe soon choke up by formation of lime cake? A. You should arrange the pipes so that they could readily be cleaned.

(31) J. B. asks: Is there any rule for finding the diameters, focal lengths, and distances apart of the field and eye lens of a Huyghens or negative eyepiece of any power; also the diaphragm aperture and distance of same from either lens? A. The focal lengths

of the lenses are as 1 to 3, and their distance apart is equal to half the sum of their focal distances. The lens of greatest focal length is the field glass. The diaphragm should be placed about midway between the lenses, and its aperture should be as small as possible without cutting down the field. Eye-pieces of different focal lengths may be used with the same objective.

(32) L. O. asks what to apply to old plaster Paris busts, that have become dirty, that will make them look like new. Dust has settled in the pores and I can not remove it. A. Give them a dead coat of china white, or you may varnish them and apply a coating of silver, gold, or bronze colored bronze powder.

(33) W. D. S. writes: 1. I have a vertical boiler, 4 feet high, 27 inches diameter (including furnace, which is internal and 18 inches high); boiler has nineteen 2 inch flues; is made of five sixteenth iron; engine, 3 inch bore, 7 inch stroke, running 350. We have not enough power to run a small planer; we use from 60 to 80 lb. steam pressure. Could we with safety increase this pressure; the boiler has been in use only 2 years; or could we run a larger engine with the same boiler, say 4½x14½? A. If your boiler is five sixteenths inch thick, of good iron, and well made, you may carry 120 lb. without hesitation. 2. I noticed in a recent number of the SCIENTIFIC AMERICAN a correspondent wants to know if oil will stop priming. I frequently use the common black lubricating oil, feeding it with feed water with good effect. Will it injure the boiler? A. No.

(34) G. H. P. asks: 1. What is the expansion of glass between 32° and 212° Fah? A. Glass which at 32° F. is 1,000,000, at 212° becomes 1,000,861. 2. How to solder brass on to a valve seat of a steam cylinder. A. Clean the valve seat, coat it with solder by means of a heavy soldering iron. Tin the brass plate, heat it quite hot, and put its tinned side downward on the valve seat. If the brass plate has not sufficient thickness to admit of this treatment you may "sweat" it on.

(35) S. A. B. asks: 1. How can I put a very high polish on steel? A. The steps in the process are as follows: 1st, Coarse wet stone; 2d, fine wet stone; 3d, buff wheel having fine emery applied; 4th, crocus, different degrees of fineness. 2. On brass? A. Finish as finely as possible with files, then with Scotch gray stone, and finally, with the powder of Scotch gray stone and oil, or with rotten stone and oil. 3. How is the so-called "Florida sea bean" polished? A. After smoothing, use powdered pumice stone and water. Finish with rotten stone and water or oil.

(36) S. F. writes: I have an induction coil, of Ladd's make (London), of the following dimensions: Length of coil proper, 11½ inches; diameter of coil proper, 5 inches; diameter of core, 1½ inch; base board containing condenser, 19½ by 9 inches; condenser plates, 19 by 8½; number of condenser sheets, unknown; length of primary wire, estimated, 75 feet; number of secondary wire, 3 miles (16,000 feet). This coil was sold promising to give a spark in air of 4 inches, but I never realized more than 3 inches, and then a feeble spark. The battery which I employed with this coil consists of four 1 gallon jars, in each of which there are immersed a zinc plate 6 by 8 inches between two carbon plates of the same size. The construction of the battery is that of Grenet; the solution in which the plates are immersed is saturated solution of bichromate of potash and sulphuric acid. Is the battery not strong enough to give the desired result, or can you suggest any other reason? A. Your battery seems to be ample. The coil may have been injured by an internal discharge, or it may be that the interrupter is not properly adjusted. If the spark from the primary coil is large it would be well to increase the surface of the condenser.

(37) C. H. M. asks: 1. For a method of producing brilliant resembling diamonds. A. Pure caustic potash, 16½ parts; white lead, 85; boracic acid, 4½; arsenious acid, 1-4; pure quartz sand, 50. These materials, carefully selected, are ground together, placed in small glass pots (the French clay pots will answer if the first charge is discarded after several hours firing) and heated to quiet fusion in a suitable furnace for about 24 hours; then cooled very gradually and cut. The art of imitating the diamond and other precious stones has attained to great perfection in Egypt and Greece, as well as in France. The following analysis by Sonault gives the composition of the colorless French *Pierres de Strass*: Silica, 38.1; alumina, 1.0; oxide of lead, 53.0; potash, 7.9; borax and arsenious acid, traces—100. 2. Give a simple method of qualitative test for the presence of silver in ore. A. Reduce the ore to an impalpable powder by grinding, gradually heat it to redness for half an hour or more, with constant stirring; boil with pure nitric acid; filter; evaporate the filtrate to small volume, and add a few drops of hydrochloric acid—a white precipitate which does not dissolve in boiling water, and blackens on exposure to sunlight indicates silver. Gold, if any, remains in the powdered ore. If the ore contains chlorides the silver may escape detection by this test. It is safer to proceed as follows: Mix the ore with 10 or 15 times its weight of finely granulated test lead—free from silver—and 2 or 3 pieces of borax glass the size of peas. In a small scorifier, and expose in a nearly white hot open muffle until the ore is fluxed and the fused metal disappears beneath the liquid slag of litharge. Then remove, cool, break, hammer, and clean the lead button; place it in a dry bone ash cupel of equal weight, and expose in the muffle until all the lead is slagged and absorbed by the porous bone ash, leaving the silver, together with the gold, if any, as a bright, clear molten button in the bottom of the cupel. Very small quantities of silver and gold in an ore may be thus detected.

(38) J. A. writes: In my last SCIENTIFIC AMERICAN, April 5, No. 14, I notice in answer to L. B., you say that 8 inch cylinder, 12 inch stroke, 150 revolutions per minute, 60 lbs. steam, 20 horse power; by my rule I only make 13.7 horse power. My figures are: Piston 50 2556 square inch 60 lbs. steam, 3015-9390 h. p. 150 rev. per m. 33,000/45250-4000 13.7 h. p.

If I am wrong, please tell me where I make my mistake. I am only a novice any way. A. 150 revolutions per minute is 300 feet; double your result and you will be then

right, except that you have made no allowance for friction.

(39) W. A. J. asks: What chemical action takes place when sulphuric acid is applied to common salt? A.

Salt Sulphuric acid = (Sodium bisulphate + Salt) + Hydrochloric acid
 $2\text{NaCl} + \text{H}_2\text{SO}_4 = \text{NaHSO}_4 + \text{NaCl} + \text{HCl}$

When strongly heated on the hearth of a reverberatory furnace the reaction is completed, resulting in the formation of neutral sulphate of soda (Glauber salt, Na_2SO_4) and hydrochloric (muriatic) acid.

(40) H. S. asks how to arrange an earth battery for nickel plating. A. We could not advise the use of an earth battery for this purpose. You should use a Smee or a Daniell battery, or one of the forms of the gravity battery.

(41) A. E. asks how to make a drill point that will enable him to drill through glass, porcelain, or transparent china pictures. A. Make the drill of the finest quality of steel, heat it to a cherry red, plunge it in mercury, hold the extreme end in a pair of cold pliers, and draw down the temper except at the end protected by the pliers. Wet the glass or porcelain with turpentine to which a little gum camphor has been added.

(42) H. L. asks what size of engine and boiler to run a velocipede capable of carrying one person, at the rate of about 6 or 8 miles an hour. A. Perhaps some of our readers will furnish this information.

(43) S. R. E. asks whether or not honey will keep in glass cans. A. Yes, if the jars are well filled and sealed air tight. 2. What is the best noted cure for bee stings? A. Dissolve 3 parts of pure carbolic acid in 5 parts of good glycerine.

(44) J. M. asks: 1. How long will the carbon remain good in a Fuller bichromate battery? A. It will last for a number of years. 2. I am running a burglar alarm in my house, with a Fuller bichromate battery, 4 one gallon cells, and No. 32 wire. Please tell me how to make an electric light in my house with these 4 cells. 2. You cannot make an electric light with four Fuller cells.

(45) A. B. P. asks: Would it not be much better in making a Siemens hand power electric machine, illustrated in SUPPLEMENT No. 161, to make the electromagnets of malleable iron, and have them permanent magnets, or can common cast iron be permanently magnetized as well? A. Neither cast nor malleable iron retains the magnetic charge to any very great extent. You will get the best results by using the electro-magnet.

(46) J. P. B. asks: If a telegraph line of No. 14 galvanized wire be used, how small a piece of boiler iron could be used in damp earth as a ground plate, to give the electricity as free a pass to the ground as over the line? A. Use a plate having a surface of 10 or 12 square feet. A thin copper plate would answer better than the boiler iron.

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

A.—It is a variety of syenite or hornblende schist—it has little commercial value.—G. S. A.—The ore contains traces of silver.—J. H. G.—It is mica schist—of no value.

COMMUNICATIONS RECEIVED.

On Binding. By E. C. M.
 On Squaring the Circle. By C. P. K.
 On a New Form of Telephone and Battery. By H. W. F.
 Horse Shoeing. By C. S.
 On Cleaning Lamp Chimneys. By S. B.
 On a Rare Geological Specimen. By H. M.
 On Animal Intelligence. By H. D. O.
 Artificial Stone Foundations. By W. M.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were
 Granted in the Week Ending
 March 25, 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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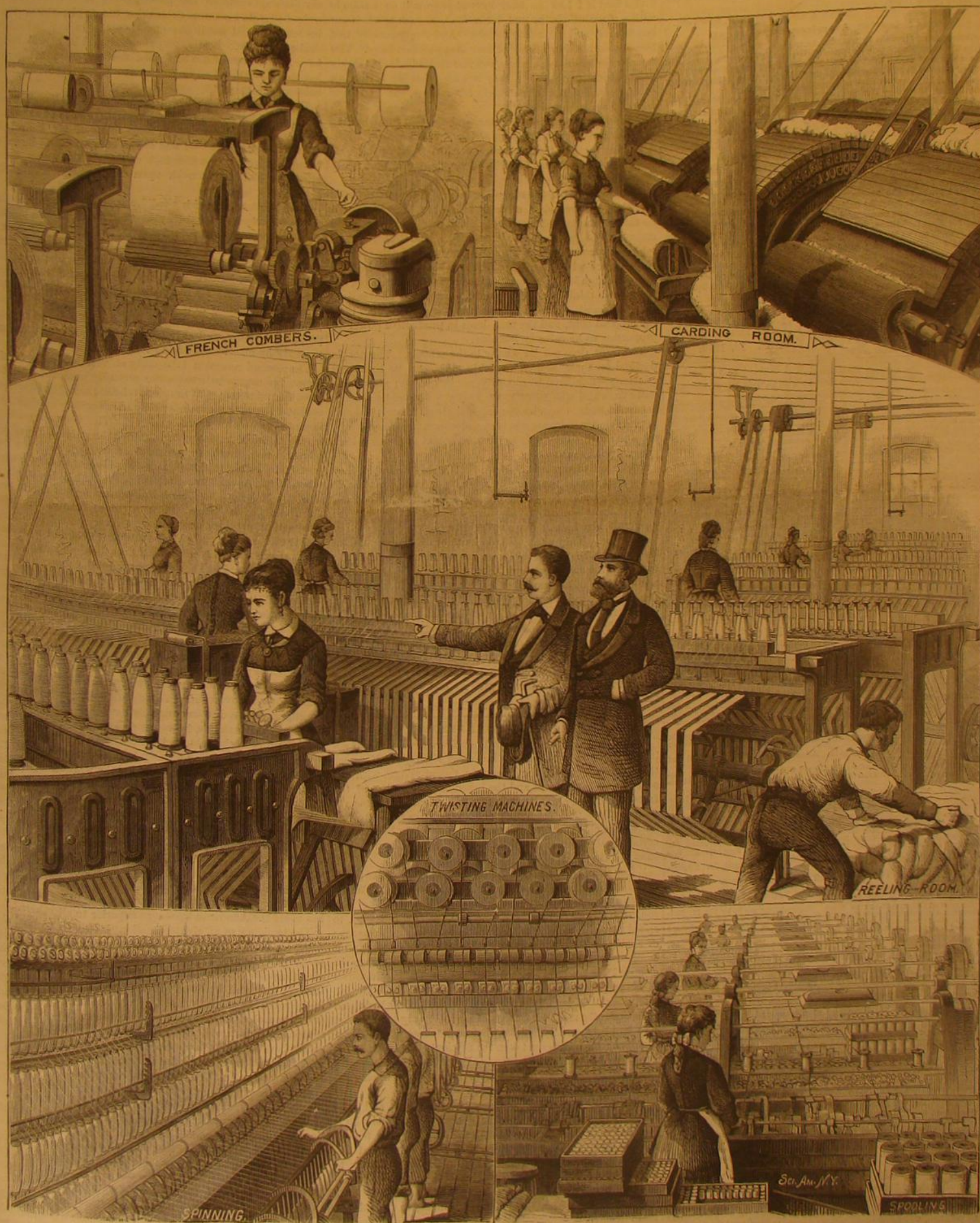
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NEW YORK, SATURDAY, MAY 10, 1879.

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- ENGINEERING AND MECHANICS.—Berdan's Range Finder. A description of General Berdan's apparatus for the speedy measurement of distances, in military and naval operations, by means of telescopes. 4 figures.
Life Saving Experiments. Recent tests of E. S. Hunt's projectile for carrying life lines to wrecks, made at Shoeburyness by the British War Office authorities.
A New Kind of Telegraph Cable. A leaden conductor insulated and inclosed in a lead tube.
Improved Hydro-Extractors Combined with Engines. 4 figures. Description of Messrs. Pierron & Delahaire's exhibits at the Paris Exhibition.
- TECHNOLOGY.—Krupp's Latest Patent for Dephosphorating Pig Iron. The Treatment of Iron to Prevent Corrosion. Discussion on Prof. Bart's lecture. (Continued from SUPPLEMENT No. 174.) Views of Sir Antonio Brady, Dr. Russell, Prof. Graham and Prof. Admiral Selwyn, and Col. Prendergast, with reply by Prof. BARFF.
The Silk Worm and Silk Production. Continuation of Prof. Riley's Instructions (SUPPLEMENT No. 174). 4 figures. Preparation for spring. Gathering cocoons. Choking the chrysalis. Egg laying. Reproduction. Reeling. Food plants. Osage orange.
Rennet's Gelatine Emulsion Process. W. Wainwright, Jr. Superiority of gelatine.
Photography in Colors. Germeul Bonnard's process. By M. K. VERNAEYEN.
Removing Iron and Wire from Wheat by Magnets. 8 figures. Method applied at Humboldt Mill, Minneapolis.
Improved Chrome Black on Wool. Suggestions made by Dr. M. Reinmann in a recent lecture before the German Chemical Society.
Oak Stair Case and Screen. 1 illustration. A specially handsome carved staircase lately finished in London.
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Speed of Electric signals.
- CHEMISTRY.—The Chemistry of Plants. Germination the sources of plant food, etc.
Manufacture of Phosphorus.
Gas as Fuel.
Chemical Items. Electro-chemical actions under pressure. By A. BOUYER.—Gas Regulator for Air Baths. By L. CHAST.
Galileo and the Inquisition. Historic facts with regard to the condemnation of Galileo by the Holy Office.
- NATURAL HISTORY, ETC.—Professor Huxley on the Lowest Forms of Life. Full report of Professor Huxley's recent lecture before the Literary and Philosophical Society of Lincoln, Eng. Moulds, protozoa, diatoms, bacteria, cause of epidemics.
Native Bitumens and the Pitch Lake of Trinidad. Continued from SUPPLEMENT No. 174.
A Recent Visit to Vesuvius. A graphic report of personal experience by an American traveler.
Glazed Frost. A description of the freezing rain which caused so much damage in France, January 23-25.—The conditions determining glazed frost.
- ASTRONOMY.—Another World Inhabited like Ours. Description of the Planet Mars, with map. Discovery of the satellites of Mars. Speculations as to the physical conditions of the surface of Mars. The color of its water and soil. Is Mars a world of sordid grass and ruddy forests?
The Tails of Comets. Professor Bredikhine's notion of three distinct classes of comets' tails.
Constitution of Nebulae. Ritter's law.
- MEDICINE AND HYGIENE.—A new Method of Treatment of Pustules in ALO. Speedy cure.
Ringworm, its transmission by domestic animals, etc. From paper by Dr. Jno. V. SHOFMAKER, before American Medical Association.
Elephantiasis and Filaria. Views of Sir JOSEPH TAYLOR and others.
The Mosquito as an Intermediary Host and Transmitter of Filaria. Its possible connection with elephantiasis.

STUDY TO HAVE IDEAS.

A suggestive story is told of the late Joseph Harrison, of Philadelphia, inventor of the sectional boiler for which the Academy of Arts and Sciences awarded him the Rumford medal, and widely known as the partner of Winans in Russian railway contracts. He was climbing the Gemmi, in Switzerland, accompanied by a young man, and the conversation fell on the younger's chances of rising in the world should he embrace the profession of mechanical engineer. Mr. Harrison favored the idea, saying that this was the age of invention and improvement, that machinery was constantly being applied to new uses, and that he who would make it a study and master it in all its forms would never lack for remunerative employment. "But I have no skill in drawing," objected the young man. "Neither have I," said Mr. Harrison, "I never had time to learn. But I have always found that if I had an idea I could express it on a shingle with a piece of chalk, and let a draughtsman work it out handsomely and according to rule. And I've generally had ideas enough to keep three or four draughtsmen busy. You can always hire draughtsmen, but you can't hire ideas. Study to have ideas, my boy." It may be added that Mr. Harrison's success was due not to scholastic advantages, but to native capacity and personal effort.

It is a significant circumstance, and one that furnishes the basis for the severest criticism of the current methods of academic instruction, that men who, like Mr. Harrison, have attained signal eminence for originality of thought have rarely been men of much schooling.

The grand aim of the schools is to furnish the student with knowledge, a great deal of knowledge in a little time. To do this the method of cram, not that of original research and critical investigation, has to be adopted. The student's mental habit becomes that of a receiver, not that of a discoverer. He is loaded with knowledge, but in taking on the load he loses, through lack of use, if not through stern repression, the capacity to think or act except along the lines of conventionality and habit. The scholastic bias becomes stronger than the original bent, and the man loses in productive power in proportion as he gains in learning.

The fault does not lie wholly in the schools. The people demand for their children a teaching that can be measured quarterly—measured by quantity, not by quality; and on this score the child who takes most kindly to second-hand ideas is sure to win. Capacity for original ideas, for original and personal independent work, is at a discount. In other words, what the man most needs to have, the child or youth is least encouraged in cultivating.

While knowledge and skill are both highly desirable, they are still of second rank, and it is possible to acquire them at too great a cost. If a man has ideas—original, individual, creative ideas—he can usually hire skill and buy knowledge; he cannot hire ideas. We should be the last to decry skill or knowledge. They are essential elements of education. But they should be gained by processes which make them the tools, not the end of culture. The man should be the master, not the slave of his learning; and whether he is the one or the other depends very largely on the way his knowledge has been gained. And it is better to be the master of a little knowledge, with capacity to use it creatively, than to be the unproductive carrier of all the learning in all the libraries. Our young readers whose scholastic advantages, so-called, have been few, may well take the lesson to heart. Study to have ideas; life will give no end of opportunities for using them.

"THE PATENT RIGHT NUISANCE."

Under this heading the New York Herald ranges itself editorially with the opponents of inventors' rights, and discusses the alleged defects of the American patent system with the zeal of a recent convert and the ingenious perversion of the facts of the case characteristic of a misinstructed or unscrupulous advocate. The article reads very like a feeler thrown out by the clever attorneys who so persistently lobbied for certain anti-patent associations before the last Congress. It runs in this wise:

"Americans are notoriously the most inventive race in the world, and the number of patents issued yearly from Washington amounts to many thousands. An inventor like Edison, who has taken out more than 200 patents, is forced to spend no small portion of his time in ascertaining the scope of analogous inventions made by his numerous rivals, and it is alleged that the success of his recent experiments upon the electric light has been seriously impaired by finding that most of his proposed improvements were already protected by letters patent. Many of the more obvious inventions have been independently made by dozens of persons, only to find that they had been anticipated long before by some unknown individual who had never taken the efficient steps to make his invention known. The issuance of a patent thus becomes, in a vast majority of cases, only a means of repressing instead of stimulating independent inventions.

"That this evil has assumed vast proportions and calls urgently for remedy will not be denied by any one who is familiar with recent discussions in the scientific and technical periodicals. It is well known that nine tenths of the patents issued are of no practical utility, and only serve to confuse the inquirer and waste valuable time. Every invention of first-class importance has to be 'protected' by a score of minor patents which have nothing to do with the main discovery.

"It has even become a question of late, in Europe and America, whether the whole patent system ought not to be

brushed away as a mere impediment to the development of manufacturing industry, leaving future inventors to rely for their compensation upon such advantages as their exceptional facilities for the production and introduction of their specialities as would naturally follow from their priority in the race and their more perfect possession of all the details. In nine cases out of ten the change would be to general advantage; still, some provision ought to be made for discoveries of far-reaching value.

"Three remedies would seem to be desirable. In the first instance the number of patents issued might be restricted at least ninety-five per cent by refusing all applications for such patents as are obviously of little or no value, as well as those which do not represent any new principle. Secondly, many of those inventions which are really of great practical importance should be at once purchased by the government for the general benefit of the public, every inventor being required to state his terms on making his application. With inventors of real merit the government can well afford to deal generously. Lastly, all patents should be considered to have lapsed when it can be shown that a reasonable period has elapsed without any effort on the part of the inventors to introduce them."

The assurance with which the name of Mr. Edison is made a peg on which to hang a sweeping indictment of the patent system is positively amazing. Just think of Mr. Edison as a victim to patent rights! and of the community at large as being deprived of the blessings of electric lighting because other men had been at work upon the problem before Mr. Edison took it up!

If Mr. Edison's word is good for anything, the public has the best of reasons for believing that, so far from having been hampered by the patent system, he has, as an inventor, been largely a product of it. Without the protection it has given him he would never have been an inventor; certainly he would never have devoted his life to that laborious and expensive pursuit. He has made invention his business because there is money in it to him, though infinitely greater profit to the world at large. His inventions are paying property, because, and only because, they are protected as property by all civilized nations.

The second assertion is equally at variance with truth. Grant, for argument's sake, the absurdly untruthful statement that nine tenths of the patents issued are of no practical utility. Does it follow that "they only serve to confuse the inquirer and waste valuable time?" The very opposite is true. A liberal patent system insures the publication of all efforts in new directions, and that is a matter of infinite importance. In his exploration of the unknown every inventor strikes many blind or doubtful paths. Shall he, or shall he not pursue them? Time is limited and he has far to go. The records of the Patent Office ought to furnish him the results of all previous explorations. Every patent issued is, in this way, a means of saving fruitless effort and waste of time. Even "worthless" patents thus become valuable, as warning signboards to the explorer. In the records of the Patent Office he reads: "A tried this way and found it unprofitable;" "B tried this—no thoroughfare;" "this road leads to the property of C;" "this to where D was lost in fruitless exploration;" and he guides his efforts accordingly.

The great object of the patent law is to secure the early publication of all these mental itineraries; and every measure calculated to prevent their publication is mischievous. Not unfrequently, also, the "worthless" patent fails for lack of some means for overcoming a special difficulty, which means are supplied by a discovery made after the life of the patent has expired. It stands, however, a permanent contribution to the history of thought, and the next man is saved the first inventor's fruitless toil; he freely bridges over the difficulty by the aid of the last discovery, and the world gets a valuable invention which it would have missed had the original "worthless" invention vanished unrecorded.

The Herald's next statement with regard to the recent tendency of American and European thought, with respect to the policy of issuing patents for inventions, is another flat misstatement of fact. The current of thought, not only among the common people, but among statesmen, is decidedly in the direction opposite to that asserted. Witness the steady progress of foreign patent systems toward the liberality which has made the American system so superior to all others.

The tendency of all civilized nations is steadily toward the fuller and freer recognition of the rights of intellectual property. Countries which, like Switzerland, originally denied the possibility of intellectual property, proclaimed "free trade in ideas," and refused to recognize the inventor's right to the products of his inventive toil, have learned that sound policy as well as abstract justice demands an advance to the position of higher civilization, and are copying the American patent laws so far as they are able to.

The limitations of space forbid an extended notice of the Herald's "remedies." They have been presented in every possible aspect, by the agents of anti-patent associations, in the committee room and in Congress, only to demonstrate more clearly their pretentiousness, the impossibility of putting them into practice, and the certain injustice to inventors, small manufacturers, and the public at large, that would flow from an attempt to carry them into execution.

ENGLISH VS. AMERICAN RAILS.

A short time since Mr. Vanderbilt purchased in England, for the New York Central Railroad, 10,000 tons of steel rails. These rails cost, on shipboard, £5 a ton. To this must be added a duty of \$28 a ton, making the cost of the rails here

about \$53 a ton. The price of American steel rails is from \$45 to \$47 a ton; in large lots perhaps as low as \$43. It is clear, therefore, that Mr. Vanderbilt paid for the English rails something like 25 per cent more than American rails would have cost him.

Against this bargain certain American gentlemen, professing to speak in the interest of American rail makers, have protested with much vigor. One of these gentlemen, Mr. Alfred Earnshaw, of Philadelphia, after taking Mr. Vanderbilt severely to task for wasting his stockholders' money, closes his letter with these words:

"If a railroad president has any duties toward his stockholders, if a man occupying high public places has any duties toward the well-being of a great national industry, and if the railroads have any duties toward American steel rail makers in return for their services past and present, Mr. Vanderbilt's duty bids him plainly and openly give his reasons for this purchase."

When approached by a *Tribune* reporter, Mr. Vanderbilt pardonably declined to be brought to book after the fashion proposed. A "prominent official of the New York Central Railroad" proved less reticent, and explained the transaction in a way that, if true, reflects little credit upon the manufacturers of steel rails in this country. He said that the order was not given for the English rails until careful tests, chemical and other, had proved the English rails to be worth the price. The English manufacturers gave a guarantee of twelve years' wear, all rails not coming up to the standard to be replaced free of cost. Every American manufacturer applied to declined to furnish such a guarantee, five years being the longest time for which a guarantee was offered. "It is well known to railroad men," said the Central officer, "that the utmost limit of wear for American steel rails, as now manufactured, is five years, where they are subjected to the strain of heavy traffic such as continually passes over the New York Central road. Some of the English rails now laid on this road have been in constant use for many years without showing the least evidence of wear, while American steel, laid at the same time, has worn out, and must be replaced." That (these conditions being true) the English rails were the cheaper and the bargain a good one goes without telling.

There remains, however, a serious question for the American rail makers to answer, namely, Why are American rails inferior to the English? Mr. Earnshaw writes: "In justice to Mr. Vanderbilt, I will say that I believe it to be true that the American rails laid on his Western roads have worn out quicker than the foreign rails, but their life has not been sufficiently short to account for the difference in price."

On the contrary, the difference between a five years' guarantee and one for twelve years does amply justify the payment of a price larger by only 25 per cent. And the case against the American rail makers is even worse than appears on the face of this transaction. The American maker has in his favor a duty which practically doubles the cost of English rails in this country. Why is it, then, that the American manufacturer cannot make for \$50 as good a rail as the English can for \$25? The English price is no doubt exceptionally low just now; but the duty more than equalizes the conditions.

Since the foregoing was in type, the president of the American Iron and Steel Association, Mr. D. J. Morrell, has replied in the *Tribune* to the statements of the railway official quoted by the reporter of that paper. Mr. Morrell says that the alleged inferiority of American rails is not sustained by fact; and that the asserted brevity of the life of American steel rails "is a bold assertion of what is absolutely and entirely untrue." He says: "That some American steel rails may not under certain conditions last five years or even one year may be true, and it is equally true of foreign rails. The usual guarantee of American rails is five years' wear, with an agreement to replace all such as give out from fair usage within that time; and for this guarantee no extra charge is made. It is not fair for Mr. Vanderbilt to suppose that all American manufacturers of steel rails are so stupid as to make an inferior article, when, with the best of materials to start with, they can with the practice of intelligence and skill make a good rail with just as little cost as they can an inferior rail."

Further on Mr. Morrell says: "The hardness of temper of the rails is regulated by the amount of carbon the steel contains, and this is usually controlled by the roads that use them, some railroad managers requiring their rails much softer than others, preferring toughness and immunity against possible accidents from breaking, to the extreme hardness which would insure greater endurance. American rails have been used for more than ten years on many of our leading roads, and for the last six or eight years more than a million and a half tons have been put down, and I am ignorant of the first instance of any such complaint as would justify the assertion so boldly made by this 'prominent official'; indeed, I know exactly to the contrary."

In every large lot of rails there is a liability to be a few imperfect ones, from flaws in the ingot or from mechanical defects which cannot be detected by the closest and most careful inspection, but these imperfections usually disclose themselves during the first few months' service. This is equally true of English as well as American rails. The number of rails so failing within five years is so inconsiderable that the guarantee has never been considered any great hardship to manufacturers. If the utmost life of American rails is limited to five years, as asserted by a "prominent official," the New York Central might have its road kept con-

stantly supplied with new rails under the usual American guarantee, without any expense to the company beyond the first outlay."

Touching the asserted twelve years' guarantee, Mr. Morrell says:

"I am not aware that Mr. Vanderbilt has ever asked for twelve years' guarantee from American makers, or even asked from them, certainly not from very many of them, at what price or on what terms they would supply his wants. His purchase of these foreign rails would seem to have some other motive than the one given. The 'economy' plan is too thin for credence."

While the indications are that the immediate interests of the Central Railroad may not have been the controlling element in determining this transaction, the makers of American steel rails are still left under the burden of a serious implication. It is not sufficient for them to deny the alleged inferiority of their rails. The charge must be disproved by specific and abundant evidence. The New York Central road is not the only road that has a large traffic, or that has tried American steel rails.

If other roads, under severe tests, have found American rails as durable as the English, their testimony would just now be of great value. If, as Mr. Earnshaw admits, they have not worn so well as English rails, it is the duty of the American makers to explain the cause, if they can, and remove it.

A REMARKABLE CONFLAGRATION—THE RIVER BETWEEN NEW YORK AND BROOKLYN SET ON FIRE.

One of the important receiving stations of the Standard Oil Company in this city is near the foot of Sixty-fifth street, on the bank of the Hudson River. Here the company have tanks for the storage of oil, which is brought directly into their premises in cars that come to the city over the New York Central and Hudson River Railway. From this station the crude oil is in part distributed in barrels to the shipping along the river, and to other points, but a large portion is transferred through a pipe line directly to the refinery at Hunter's Point, in Brooklyn. This pipe line extends under the streets of New York across the city to the East River, and thence under the bed of the river to the Brooklyn shore. The river at the point where the pipe line crosses is about three-quarters of a mile wide, a large and splendid stream, usually covered with sailing and steam vessels engaged in the ordinary services of the commerce of a great city like New York. The entire length of this oil pipe line is three miles, the oil being forced through it from the Hudson River to Brooklyn under a strong pressure, by means of a large Blake steam pump. On Sunday morning, April 20th, at a time when the river happened to be comparatively free from vessels, an appearance something like a water spout was observed on the river near the Brooklyn side. The water rose high up in the air and fell in graceful showers all around. In a very short time the surface of the channel was covered with oil, which naturally spreads rapidly on the surface of water and which was carried down stream also by the ebbing tide. This explained the unusual phenomenon. The oil pipe had burst at the bottom of the river and the oil was flowing in a big stream to the surface. Several little boys who were playing around the dock noticed the oil and promptly threw some lighted matches into the river. The oil ignited, and in a few seconds the whole river front was ablaze, and the dock also caught fire. The boys ran away rather more scared than happy. The fire engines were sent for as quickly as possible. Three responded. The fire on the dock, in rear of which are gas works, was quickly extinguished, and in about a quarter of an hour there was no appearance of fire on the river. But just as the firemen were about to leave, flames shot up here and there along the channel. Now and then, fanned by fitful gusts of wind, they lengthened enormously, and swept the fences and trees along the river front, scorching them here and there.

The oil continued to bubble up from the leak at the bottom of the sea, and the flames in that vicinity rose to a great height. It was not until all the oil in the pipe had risen to the surface and had mostly been consumed that the flames died out. This was fully four hours after the outbreak. The quantity of oil lost must have been very great. Beyond the scorching of a few vessels, the fences, trees, and the partial destruction of the dock, there was no other harm done.

Cleveland to be Lighted by Electricity.

We learn that the authorities of Cleveland, Ohio, have made a contract to light a large portion of the city with the Brush light. The lamp posts, which are very ornamental, and twenty feet high, have all been erected, and it is expected that the lamps will be placed in position in a short time. The results of this generous experiment in electric lighting will be noted with great interest by the public in general and electricians in particular.

PLASTER of Paris mixed with equal parts of powdered pumice stone makes a fine mould for casting fusible metals. The same mixture is useful for incasing articles to be soldered or brazed. Casts of plaster of Paris may be made to imitate fine bronzes by giving them two or three coats of shellac varnish, and when dry applying a coat of mastic varnish and dusting on fine bronze powder when the mastic varnish becomes sticky.

AMERICAN INDUSTRIES.—No. 11.

THE MANUFACTURE OF SPOOL THREAD.

In our last issue we gave an illustrated description of the manufacture of sewing machines; we now present to our readers a description of the manufacture of an article without which, in its perfect form, sewing machines would be useless. Thread, although one of the smaller articles of manufacture, is the foundation of an immense industry, and the processes and machinery by which it is produced have been developed and perfected until it appears that there is little room for further improvement.

The primitive method of spinning cotton thread was to attach a bunch of the carded cotton to a forked stick called a distaff, and, holding it under the left arm, the cotton was drawn out and twisted with the left fore finger and thumb; the size and quality of the thread being regulated solely by the delicacy of the touch as it passed through the fingers. As soon as sufficient length was twisted to reach to the ground, the thread was wound upon a stick called a spindle. In this manner the spinsters of Old England made their thread, and it was not until the time of Henry VIII. that the spinning wheel—which had long been in use in India—was introduced into England. After this came the spinning-jenny, then the spinning mule, and then a host of machines for various branches of textile manufacture.

Without doubt the manufacture of thread, as conducted at the establishment of Messrs. Clark, may be taken as an example of the best practice. Entering their extensive manufactory, in Newark, N. J., one can but notice, first of all, the system, order, and cleanliness that everywhere prevail; the gleam of polished machinery, the hum and flutter of the thousands of spindles, spools, and reels, the ceaseless progression of the material from the raw to the finished state, convince us that the world must use an enormous quantity of thread, and, while wondering "where in the world" it all goes to, we are informed that this establishment furnishes only a fraction of the thread consumed in the United States alone.

A spool of cotton appears a simple thing, but when it is considered that the thread, which is so even and so strong, is composed of six cords; that the filaments which compose each cord are straightened and made parallel and twisted; that two such cords are united and twisted together, and that three of the double cords are twisted to form a complete thread, it becomes a matter of wonder that it can be profitably done for the price at which the thread is afforded to the consumer.

The machinery of the Clark Thread Works is driven by two double Corliss engines of about 500 horse power each, and several smaller engines, the power amounting to about 1,400 horse power. The engines, as well as all of the other machinery about the establishment, are in perfect order and of the finest quality.

The cotton, as it comes from the bales, passes through machines called pickers, which pick it up loosely, removing burrs, dust, and other impurities by means of a vacuum. From the pickers it passes to the lap machines, where it is similarly treated and well flattened and compactly rolled up into laps preparatory to passing through the carding machines. In the carding machines, which are shown in the upper right hand view in the engraving (front page), the fibers are further cleaned, combed, and broken, and delivered in a narrow unbroken ribbon, called the sliver, to tall cans, in which, by ingenious mechanism, it is coiled. The filled cans are conveyed to the ribbon lap machines, where a number of the ribbons are united in a single lap several times wider than the single ribbon. These laps or rolls are now conveyed to the French combers, which, with perhaps the exception of the spooling machines, are the most interesting of all the machines used in thread manufacture. They are intermittent in their action, and comb out all the short staple, leaving only the long fibers to be worked into the thread. The sliver, as it passes from the combers, looks delicate and gauzy, more like a spider's web than anything else. The machine handles it delicately, and brings it together in a narrow ribbon and coils it in the cans. This operation, which is represented in the upper left hand view in the front page engraving, is of the greatest importance, as it removes the short fibers and arranges the long ones to the best advantage.

The ribbon is next drawn and twisted in the drawing frames, and is afterward further twisted in two separate machines before spinning, and is wound upon large spools, which are carried to the spinning mules, shown in one of the lower views in the engraving. In each of these machines there are several hundred spindles, which revolve very slowly as they are carried forward by the carriage in winding the thread on the spindle, but revolve with great speed as the carriage draws back in the operation of spinning. The spinning mules are entirely automatic in their action; the attendant has only to repair the broken threads, of which there are not many. From the spinning mules the cops go to the cop winders, where two strands are wound together on a single spool. These two strands are twisted in the machine shown in the small circular figure. The bobbins revolve at a speed of about 5,000 revolutions per minute, and the thread is wound on the bobbins by a simple differential arrangement.

Three of these double strands are twisted together, making the well known six-cord spool cotton, for which this company are justly celebrated.

The spools from the twisting machines are conveyed to the reeling machines, shown in the large central figure,

where the hanks are formed. When removed from these machines the hanks are inspected by experts, who, by long practice, are enabled to detect a very small variation in the size of the thread, or any other imperfections.

While the thread is in hanks it is passed to the bleaching house, where it is bleached twice, being subjected during the process to a thorough soaping. After bleaching, the hanks are dried and passed to the hank winding machine, where the thread is wound on large spools preparatory to spooling. The spools, we are informed, are made in Maine, it having been found that they could be made and shipped cheaper than the wood could be shipped and worked at the manufactory.

The spooling machines, which are shown in one of the lower views of the engraving, seem the very embodiment of ingenuity. They take the spools, hold them between centers, revolve them, start the thread, wind it back and forth with the utmost precision, making allowance for the beveled ends, stop when the required amount is wound, nick the spool, put in the thread, cut it off, and release the spool, all without attention. All that is required of the attendant is to see that thread is supplied, and to keep the hoppers full of spools.

The tickets which are placed on the ends of the spools are printed in the establishment, two steam lithographic presses being employed for the purpose. The bronze is applied to the tickets by a bronzing machine, and they are gummed and punched by hand.

The tickets are very rapidly applied to the spools by girls, who hold a small package of them in one hand, passing them one at a time into one side of the mouth, while they are taken by the other hand from the other side of the mouth and applied to the spools. By continued practice the hand becomes very dexterous.

The boxes which contain the spools are made by an army of girls, and the label and other printing is done in a printing office containing two Hoe cylinder presses and two other small presses.

The Clark thread is well known throughout the world, and the familiar trade mark, O. N. T., is the guarantee of a good article.

The New York office of Messrs. Clark is on Broadway, at Walker Street.

THERAPEUTIC MACHINERY.

We herewith give illustrations from *Engineering* of some very interesting machines exhibited by Messrs. Goransson & Co., of Stockholm, at the recent Paris Exhibition. These

machines are intended for use in surgical gymnasia. The machine shown in Fig. 1 is intended for the development of the muscles of the wrist and arm, and is worked by means of the handle mounted on the spindle which carries the upper of two pulleys at the top of the frame. A crossed belt passes to a second pulley, on the axis of which is a crank that gives motion to a long lever hinged to a separate standard, and carrying a sliding weight by means of which the strain on the operator's wrist can be varied at will. The machine represented in Fig. 2 is specially intended for developing the muscles of the chest and back. The patient sits upon the stool in front of the machine, the height of which can be regulated at will; he then places his arms in the crutched rests, his back being toward the machine, and the latter is then started. Motion is imparted to the rests, which alternately recede and advance, as also does the padded lever below, the function of which is to exert a pressure against the patient's back, at the same moment that the rests recede, with the result of expanding his chest. The arrangement of the machine permits of the most minute adjustment for regulating the degree of expansion and speed of working.

MISCELLANEOUS INVENTIONS.

Mr. Albert Back, of New York city, has patented a design for neck ruching, in which a new ornamental effect is secured by giving it two or more folds, arranged so as to present parallel sides running in the direction of the length of the ruching.

An improved roofing composition, recently patented by Mr. Joseph E. Bowen, of Leavenworth, Kansas, has a coal tar base, combined with other ingredients, that render it efficient and durable.

An improvement in cabinet bedsteads, in which the detachable head board and its base are combined with a rod which forms the axial support for the upper end of the folding bed frame, has been patented by Mr. Mark Crosby, of Wakefield, Mass.

An improvement in sounding boards for upright and other pianos has been patented by Mr. Albert H. Wood, of New York city. The object of this invention is to prevent the escape of vibrations, and to utilize to the greatest extent the vibrations of the strings.

A blinder for taming and restraining vicious cattle has been patented by Mr. Byron W. Webster, of Acra, N. Y. It consists of a metallic plate united to a U-shaped wooden piece which is secured in place by buckles and straps.

Mr. Peter Provost, of Minneapolis, Minn., has patented an improvement on the grain drier for which letters patent were granted to him May 21, 1878. The object of the improvement is to regulate the passage of the grain through the drier so that it may be properly heated in its passage through the apparatus.

An improved envelope, patented by Mr. James P. McCullough, of Frankford, Philadelphia, has an inside pocket and flaps adapted to fold inside the pocket and close the envelope effectually.

An improvement in apparatus for preventing the boiling over of liquids has been patented by Mr. L. McLaws, of Savannah, Ga. It consists of a perforated cone rising from the bottom of the boiler and provided with downwardly bent spouts. It is designed especially for sugar pans holding from 40 to 80 gallons.

An improved preparation of coffee, in tablets or stick form, has been patented by Mr. Joseph B. Sultzer, of New York city.

Mr. E. E. Hawkins, of New Lisbon, N. Y., has patented an improved whip socket, which is formed of wire coiled spirally, with its upper and lower coils closed together for receiving pieces of rubber for holding the whip.

Mr. William A. Bradford, of Goshen, Ind., has patented an improvement in school desks, in which the wooden slats forming the seat are secured by a cheap and novel fastening.

A cotton bale tie, in which the ordinary tie loop or buckle is used in connection with a fastening wedge, has been patented by Mr. Henry A. Burr, of Wilmington, N. C.

An improvement in dental forceps, in which the forceps, with the exception of the inside of the jaws, are covered with a non-conductor of electricity, has been patented by Mr. Amase Cobb, of Beloit, Ohio. The forceps are used in connection with a galvanic battery.

Mr. R. E. Miles, of Louisville, Ky., has patented an improved breast collar, which may be readily adjusted to any sized neck and allows great freedom to the motion of the horse.

An improvement in Venetian blinds, which consists in a novel mode of connecting the slats and a new arrangement of cords for operating the slats, has been patented by Mr. Thomas Langdon, of Castroville, Cal.

Mr. Henry N. Rawson, of Brattleborough, Vt., has devised an improved renovator for cleaning and renovating feathers, horse hair, and similar material, by exposing it to the action of steam. The apparatus cannot be clearly described without an engraving.

An improved fire escape ladder, devised by Mr. Joseph R. Winters, of Chambersburg, Pa., is designed to carry the fire engine hose as well as to afford a means of escape from burning buildings. It is strong, simple, and effective.

An improvement in portable railway tracks has been patented by Mr. Joseph Morgan, Jr., of Wilmington, Del. The invention consists in combining shoes made of channel shaped iron with the rail sections, so as to lock them securely together, and still admit of readily separating the sections.

Mr. Jacob Simonson, of Newark, N. J., has patented an improved railway platform guard, designed to protect passengers against falling or being pushed upon the track. It is readily folded out of the way to permit passengers to pass from the platform to the cars.

An improved steam railway brake has been patented by Messrs. J. F. Waite and S. Gavitt, of Tyrone, Pa. It requires no brake couplings and it is always in condition to operate.

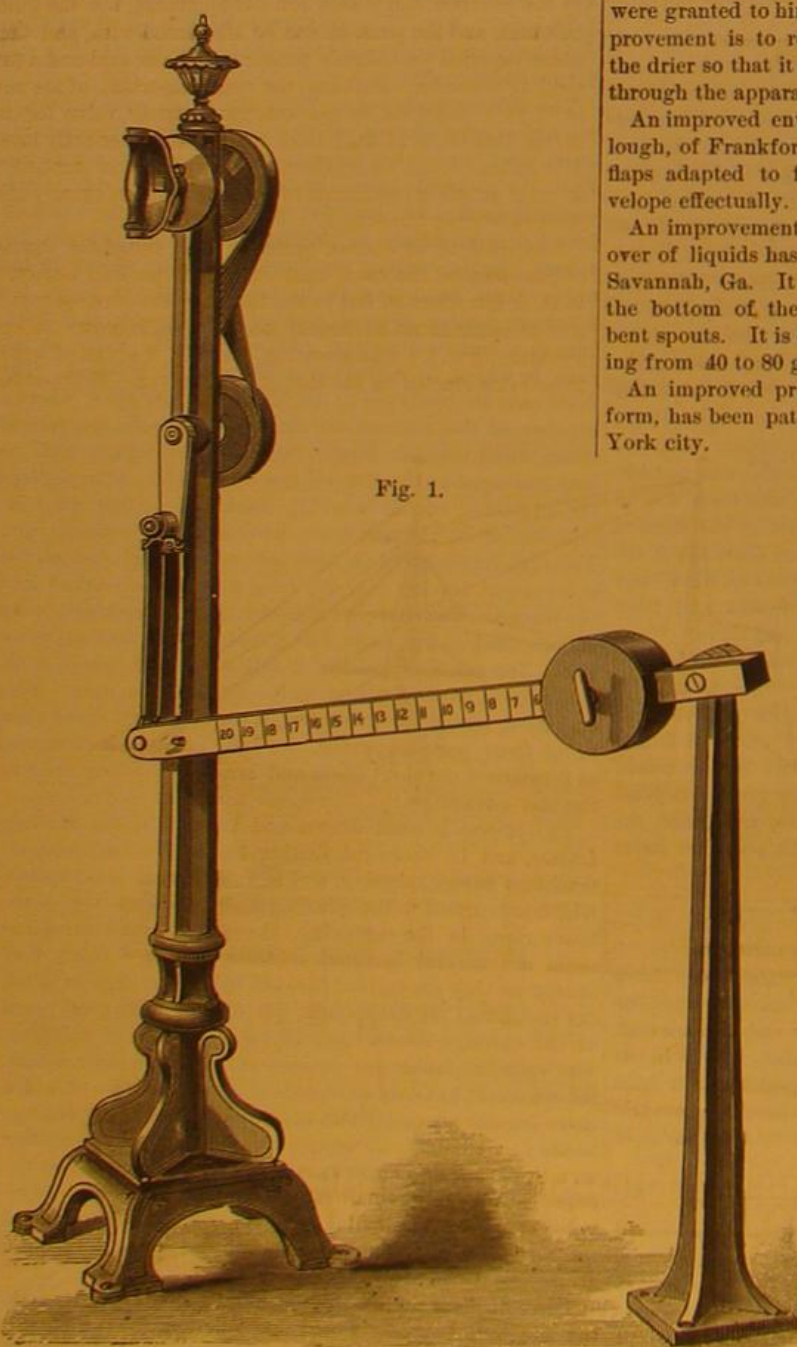


Fig. 1.

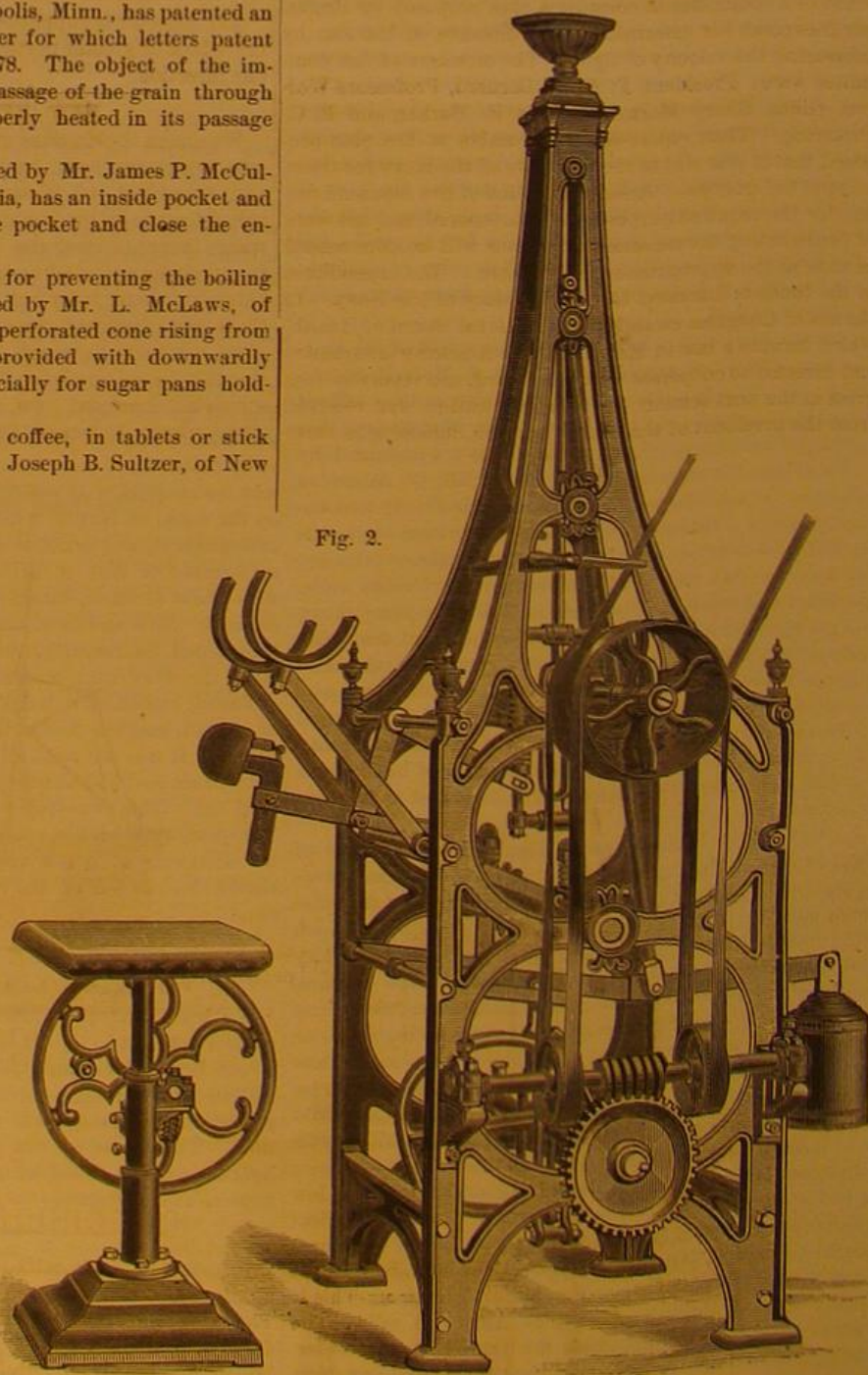


Fig. 2.

Dr. Isaac Hays.

Dr. Isaac Hays, for fifty-two years editor of the *American Journal of Medical Sciences*, died at Philadelphia, April 13. Although eminently successful as a practitioner, Dr. Hays' reputation rests almost exclusively upon his connection with medical periodicals and his contributions to transactions of the numerous learned societies of which he was a member, at home and abroad.

Dr. Hays joined the Academy of Natural Sciences in early life, and was always an active member, serving as president from 1865 to 1869. He was also one of the original staff of Willis' Hospital, filling the position of surgeon in that institution from its organization until about 1857. In 1830 he was elected a member of the American Philosophical Society, and subsequently curator, and up to the time of his death was a member of its Board of Councils. He was the oldest living member of the Franklin Institute, of which he was one of the founders, and for a number of years its secretary, and was also prominent in the foundation of the American Medical Association, of which he was the first treasurer, serving in that capacity for a number of years. Dr. Hays was chairman of the Building Committee of the College of Physicians, and it was principally through his efforts that the present building at Thirteenth and Locust streets was erected.

Besides contributing to the periodicals with which he was connected, Dr. Hays was also a contributor to the *Transactions of the American Philosophical Society*, one of his latest being a paper on the occasion of its recent centennial anniversary, and the author of the *Code of Ethics* adopted by the American Medical Association in 1847, and since adopted by every State and county medical association in the United States. Among his principal literary labors was the editing of Hall's edition of Wilson's "American Ornithology," Philadelphia, 1828; Hoblyn's "Dictionary of Medical Terms," etc., 1846; a new edition of the same, from the last London edition, 1855; Lawrence's "Treatise on the Diseases of the Eye," 1847, and successive editions; and Arnott's "Elements of Physics," 1848.

Dr. Hays was born in Philadelphia, July 5, 1796, and was the oldest living editor in continuous service in America.

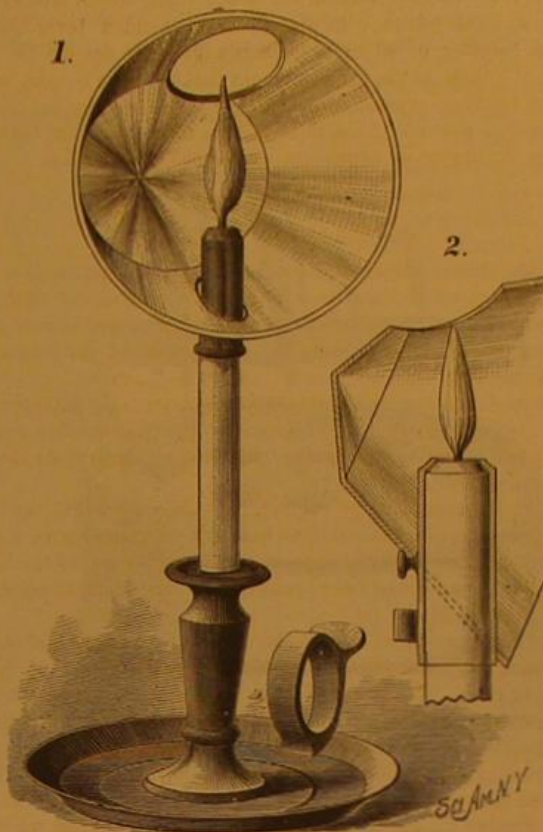
Five Thousand Dollars to find out the Distance of the Sun from the Earth.

At the meeting of the National Academy of Sciences in April last, a resolution was adopted authorizing the appointment of a committee to consider a plan proposed by Professor Newcomb for determining the distance of the sun by measuring the velocity of light. The members of the committee were: President F. A. P. Barnard, Professors Wolcott Gibbs, Henry Morton, George F. Barker, and E. C. Pickering. Their report was so favorable to the plan proposed that it was sent to the Secretary of the Navy for transmission to Congress. An appropriation of five thousand dollars for the required purpose was thus secured, and the work of constructing the necessary apparatus will be commenced as soon as the appropriation is available. The expenditure of the funds is intrusted to the Secretary of the Navy. In the act of Congress establishing a National Board of Health, which became a law in March last, the Academy is requested and directed to cooperate with this board, and report to Congress at the next session. A communication was received from the president of the board April 15, inclosing a certi-

fied copy of the act, and requesting the Academy to appoint an agency with which the board will confer to carry out the provisions of the law.

REFLECTOR FOR CANDLES.

The accompanying engraving shows a novel device, recently patented by Mr. M. C. Meigs, of Washington, D. C., for utilizing the light from a candle. The invention consists in a cap, or partly closed tube, carrying a small reflector; the cap being of the proper size to receive the end of the candle. As the candle burns down the metallic cap settles down and keeps the reflector always in the same position in relation to the flame.

**MEIGS' REFLECTOR FOR CANDLES.**

The reflector is supported in such a position as to throw the whole or greater portion of the light in parallel rays in one direction.

NEW HYDRAULIC GRID.

We annex illustrations of a new arrangement of hydraulic grid, which has been lately brought out by Messrs. Clark and Standfield, of Westminster. This grid is especially suited for use on the banks of tidal rivers and other places where there is a large rise and fall of tide, and also for use in wet docks and tidal basins, provided it can be constructed before the water is let into the dock. In such cases Messrs. Clark and Standfield consider that it may be constructed at about one half of the cost of an ordinary graving dock. It can also be advantageously used in deep water, but at a somewhat increased cost, and whereas floating and other docks require 10 feet or 15 feet extra depth below the bottom

of the vessel, the grid requires only an additional depth of 2 feet, and is thus especially useful in shallow docks and places where the depth of water is limited. In the arrangement now illustrated, the vessel is raised by a row of hydraulic presses sunk in the ground directly under the center of the grid and the keel of the vessel, with a few additional presses at the sides under the shoring frames to keep the grid level and give transverse stability. They are divided into three groups, with an equal number of presses in each group; one group supports one third of the length of the vessel, and the other two groups support the remaining two thirds, one of them controlling the port and the other the starboard side, so that the vessel may either be maintained level or put on an uneven keel at pleasure. The grid is a strongly built longitudinal wrought iron girder directly under the keel of the vessel, with ribs projecting from each side to carry a working platform. Some of the central ribs carry side shoring frames, which are used in conjunction with the sliding keel blocks.

In using the dock the grid and presses are lowered to the bottom, and the keel of the vessel is brought directly over the center and secured in position by the bilge blocks and side shoring frames, the presses are then worked and the vessel lifted till the grid is above high water mark. When in this position a number of struts or swinging frames (which were previously held up in a horizontal position under the grid) are liberated and allowed to hang in a vertical position. The grid is now lowered a few inches until the whole of these struts rest on raised bearings cast on the head of the presses, and the whole weight of the vessel and grid rests on them. The rams are now allowed to sink down into the presses, where they remain in fresh water, and are consequently not exposed to rust. The supports are hinged or swung at the top so as to fall accurately into their places, and suitable means are provided for raising and lowering them simultaneously by means of chains and shears. These frames are of considerable breadth, and some of them swing transversely and others longitudinally, so as to obviate any tendency of the grid to move in either direction. There are also, in addition, strong cast iron columns, with guides, against which the grid slides as it rises and falls. The pumps, pipes, and valves are similar to those used in ordinary hydraulic docks, and the method of working them is so well understood as to require no description.

The advantages of the hydraulic grid arise from its economy in first cost and the small weight of material required. The rams are applied directly beneath the vessel, and in consequence of this the transverse girders which carry the pontoon and vessel, the lifting chains, the tall guide columns, and the pontoon can be dispensed with, and their place supplied by a simple pontoon girder or grid and a few guiding columns. Perhaps the most important of the new features in the dock is the automatic safety valve for insuring that the grid shall at all times remain perfectly level. The action of this arrangement is such that it is impossible to raise or lower one corner of the grid without equally raising or lowering the others.

This dock is, of course, perfectly well suited for the use of pontoons of the usual character, and the only objection to their introduction lies in the fact that the pontoon would cost as much as an additional dock. Fig. 1 shows an end elevation, Fig. 2 a side elevation, and Fig. 3 a plan of one of these grids erected on the side of a tidal river.—*Engineering.*

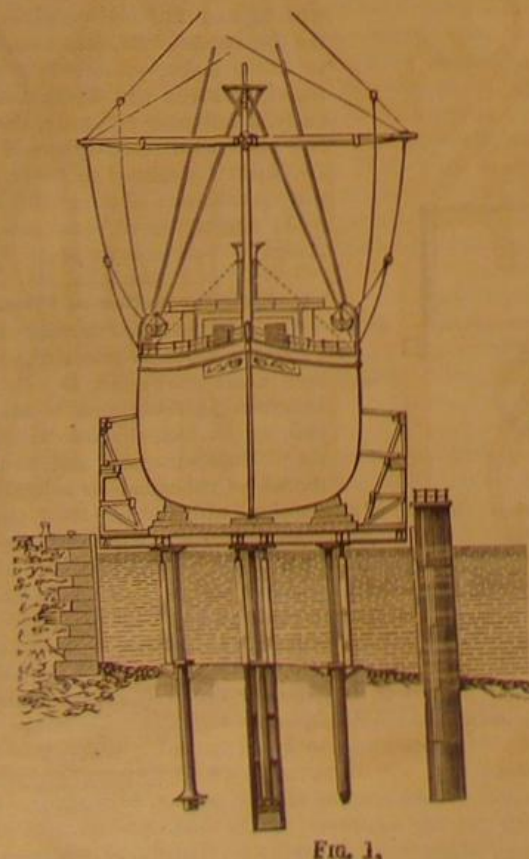


FIG. 1.

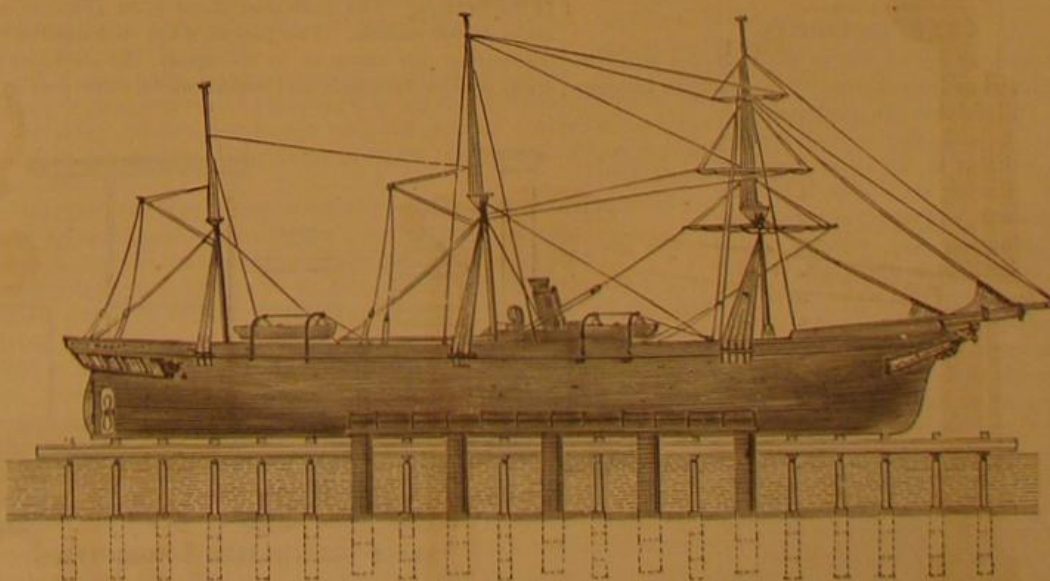


FIG. 2.

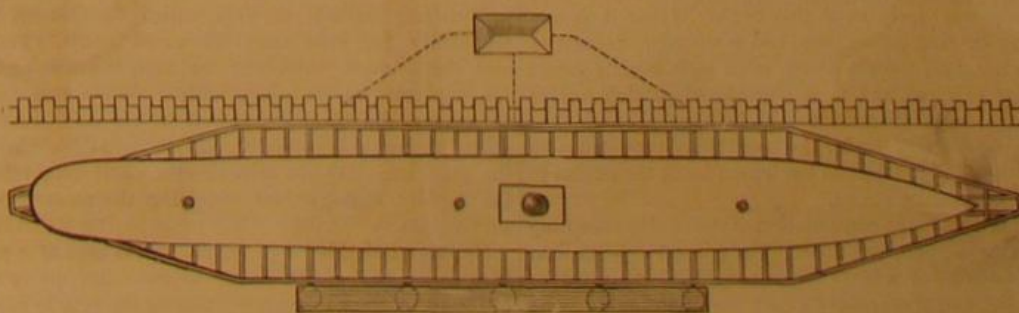


FIG. 3.

NEW HYDRAULIC GRID.

Pain and the Weather.

In his paper on the relation of neuralgic pain to storms and the earth's magnetism, read before the National Academy of Sciences, Professor S. Weir Mitchell reported the following observations:

Captain Catlin, U. S. Army, lost a leg during the war, and since that time has suffered from traumatic neuralgia, sometimes in the heel, but more frequently in the toes, of the foot. He has carefully noted the effects produced on himself by changes of the weather. Dr. Mitchell's own studies in this case, as he says, "would never have proved successful had it not been for the unusual ability, interest in the task, and perseverance of the accomplished gentleman who has obliged me by making his own torments useful in the solution of the question of how far weather effects the production of certain kinds of pain." The hourly observations cover a period of five years. "For the first quarters of these five years there were 2,471 hours of pain; for the second quarters, 2,102 hours; for the third quarters, 2,056 hours; and for the last quarters, 2,221 hours. The best yield of pain is in January, February, and March, and the poorest in the third quarters, July, August, and September. During these five years, while the sun was south of the equator, there were 4,692 hours of pain against 4,158 hours while it was north of the equator; and the greatest amount of pain was in the quarters beginning with the winter solstice, and the least was in those beginning with the summer solstice. The average duration of the attacks for the first quarters was 22 hours, and for the third quarters only 17.9 hours.

By taking the four years ending January 1, 1879, it is found that of the 537 storms charted by the Signal Bureau, 298 belong to the two winter quarters, against 239 for the summer quarters. Hence we have the ratio of the number of storms of the winter quarters and summer quarters corresponding to the ratio of the amounts of neuralgia for these respective periods, and the ratio of average duration of each attack for the same time corresponds closely with the ratio of the respective total amounts of neuralgia for the same periods. The average distance of the storm center at the beginning of the neuralgia attacks was 680 miles. Storms coming from the Pacific coast are felt furthest off, "very soon after, or as they are crossing the Rocky Mountains," while storms along the Atlantic coast are associated with milder forms of neuralgia, and are not felt until the storm center is nearer. Rain is not essential in the production of neuralgia.

It was found that the severest neuralgic attacks of the year were those accompanying the first snows of November and December. One of the most interesting and valuable results of this series of observations is thus stated: "Every storm, as it sweeps across the continent, consists of a vast rain area, at the center of which is a moving space of greatest barometric depression, known as the storm center, along which the storm moves like a bead on a thread. The rain usually precedes this by 550 to 600 miles, but before and around the rain lies a belt which may be called the neuralgic margin of the storm, and which precedes the rain about 150 miles. This fact is very deceptive, because the sufferer may be on the far edge of the storm basin of barometric depression, and seeing nothing of the rain, yet have pain due to the storm.

A NEW LOCOMOTIVE.

The accompanying sketch shows the plan of a small locomotive designed and constructed by the Baldwin Locomotive Works, Philadelphia, Pa., especially for sugar plantations and other similar service, where it is desirable to use either wood or coal as fuel. Having six wheels it is quite steady on the track, and moves along smoothly without plunging and without undue wear either in itself or in the track. It will be noticed that the fuel and water are carried at the back of the engine by the pony truck; by this arrangement the distribution of weight is made as nearly perfect as possible, and the center of gravity is kept low. The weight of the boiler and machinery is carried on equalizing levers midway between the driving wheels, so that the weight is equally distributed on the four driving wheels. This arrangement renders it impossible for an excessive weight to come upon any one wheel. It is never necessary to turn the engine, as the engineer can have a good view in either direction. One of the most important features of this engine is that it is carried on three bearing points only, and is therefore peculiarly adapted to a rough, uneven track, such as is usually found on a logging railroad, and it is capable of passing curves much more readily than a four or six wheeled connected engine, the pony truck under the tank being provided with a swinging bolster and radius bar which leads the engine to a curve when running ahead.

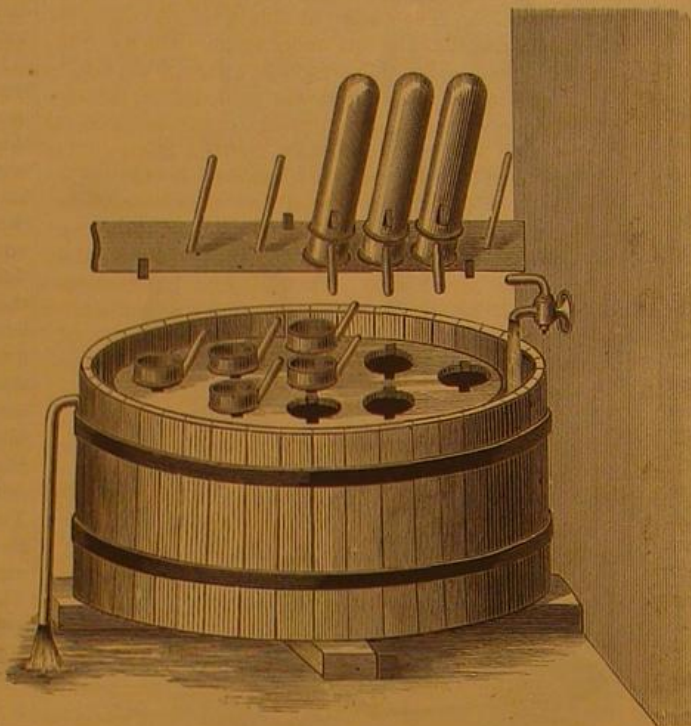
No wood is used in the construction of the engine excepting the bumper beam, cab, and floor. The general arrangement of the parts admits of a large fire box, which is required for burning wood, and if necessary a rack may be placed around the water tank for holding wood. The manufacturers inform us that the style of engine may have a separate tender,

and the truck may have four wheels instead of two, if preferred.

MILK COOLER.

Our engraving shows the Austrian mode of cooling milk, which is very simple and, in some respects, novel. It consists of a vat or tub through which cold water is constantly circulating. On the surface of the water floats a circular wooden plate, provided with a number of round holes, into which are inserted the vessels containing the milk. These are made of sheet zinc, two feet long, and each, according to the *Wiener Lande. Zeitung*, contains a little over a gallon of milk.

It takes about fifteen minutes to cool the milk down to a temperature slightly above that of the surrounding water. When not in use the cylinders are turned up-

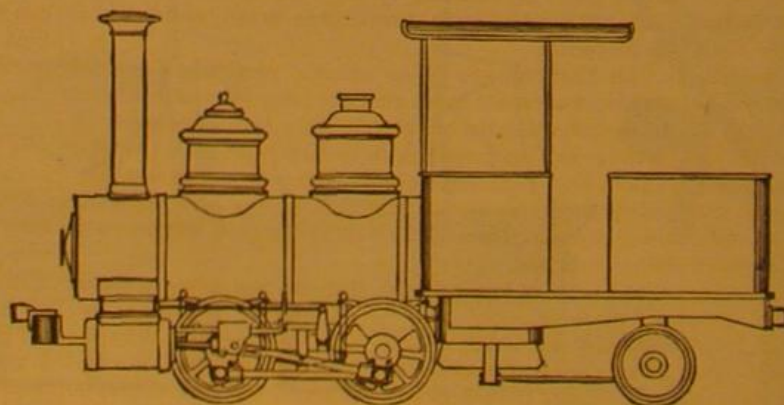
**THE VIENNA MILK COOLER.**

side down, on a wooden rack, as shown in the engraving, to drain and dry.

Cheap Freight.

The transport of Pittsburg coal to the towns along the Ohio river is described as the cheapest freight transport in the world. The *Commercial* of Louisville, Kentucky, tells how the business is managed.

In and about Pittsburg there are 50 operators or firms engaged in the coal business; about one half of whom sell at the mines, the other half are shippers engaged in running coal to southern ports. The shipments for Southern consumption from Pittsburg amount annually, on an average, to 80,000,000 bushels of coal and 20,000,000 of coke, which is sent south by the shippers on the tides as they occur. For this purpose they employ 96 tugs or tow boats and about 1,500 barges and shells in which the coal is transported. Each barge costs about \$1,000 and carries from 12,000 to 13,000 bushels. The shells cost about \$500 and they carry about 24,000 bushels. The barges, when unloaded at their destination, are returned to the mines; the shells are generally sold in the South and broken up for other uses by the

**SMALL SIX-WHEELED LOCOMOTIVE.**

purchasers. On an average there are ten coal tides or rises at Pittsburg during the year, which occur suddenly, and frequently last only from 24 to 36 hours. The barges and shells must, therefore, be kept loaded and ready for departure at an hour's notice. When the opportunity arrives, the tugs are lashed to the tugs, each taking about 10 barges, containing, say, 150,000 bushels of coal, the great length of the tows and the short time allowed by the rapidly falling river requiring the most expeditious movements.

By this admirable barge system coal is kept at a price but little above that of Pittsburg to the cities above the falls of the Ohio, the expenses of running the coal to Louisville, including the cost of returning the barges to the mines, being only about 1 1/4 cent per bushel.

Discovery of Male Eels.

We are glad to state that finally what we believe to be genuine male eels have been discovered. In the January number of this journal it was announced by Prof. Packard that he had discovered male eels. A number of the supposed males were afterward again examined, by Prof. Packard and Dr. C. S. Minot, who were then led to conclude that the so called male eels were immature females, and the mistake was corrected by Prof. Packard in the February *Naturalist*. A large number of living eels were then examined by Messrs. Packard, Kingsley, Pierce, and Minot without success, until at Prof. Packard's request Mr. Kingsley spent a few days at Wood's Holl, at the laboratory of the U. S. Fish Commission, in the last of February, examining living eels supplied by Mr. Vinal N. Edwards, by favor of Prof. Baird, U. S. Fish Commissioner. One hundred and ninety-three eels were there examined, and of these three were found by Mr. Kingsley to be, in his opinion, males. His observations made on these living individuals, which were speared in a pond through the ice, are as follows:

"On February 18, 19, and 20, I examined one hundred and ninety-three eels, at Wood's Holl, and found three males, the testes of which agreed closely with Syrski's figures as reproduced in the U. S. Fish Commission Report for 1873-4 and 1874-5, p. 719. Although I made careful examination I could find no external characters to separate the sexes. The three males were each about seventeen inches long, while the females examined varied from about twelve inches to nearly three feet. This average length of males agrees closely with Syrski's (430 mm. in length). The principal criticisms I would make of his figures, or rather points of difference that I found, are that his enlarged figure showing the lobulation of the testis has the lobes far more crowded than they were in the specimens I examined. His drawing of the histological structure was greatly larger than what I supposed to be the same. His cells measure, according to the explanation, about 1/10 of an inch on their major axis, while I saw nothing that could have been over 1/100 of an inch. The structure of the testis was similar to that which I have seen in the testes of the cod, perch, smelt, cat, deer, rooster, monkey, dog, and man. On teasing it out under a Tolles one fifth, I saw what I am confident were spermatozoa, although I could not distinguish the tails. The heads were oval and from

one half to one third the size of those of the smelt, or about 1/100 of an inch in length; they had an independent motion, changing their position on the slide without reference to any current in the water in which the tissue was placed, and this motion was wholly different in its character from the vibrations of the Brownian movement."

Prof. Packard examined, independently of and in company with Mr. Kingsley, preparations made by himself, and found scattered through the tissues, nucleated and nucleolated testis cells, of the same appearance as those of the animals above named, which were kindly obtained by Prof. Pierce. Moreover, Prof. Packard, found two mother-cells, containing several immature nucleated spermatozoa. So that after the examination of about five hundred female eels and three males, we are glad to be able to affirm the entire accuracy of Syrski's observations and figures, he being the first observer, so far as we are aware, who has discovered the male sex of the Italian eel. Which species of eel it was that Syrski examined is not stated. In making these investigations we have to acknowledge the aid of Prof. John Pierce, of Providence, in the use of a fine series of mounted histological specimens and lenses of high powers. He has worked jointly with us, and is of our opinion as to the sex of the three males. Dr. Minot examined one of the three males, preserved in alcohol, and found, as Freud and Brock had done previously, a follicular structure, the follicles being filled with small spherical cells, which Dr. Minot considered to be probably immature spermatozoa, although the development could not be traced.—*Advance proof from American Naturalist for May.*

Singular Action of Pilocarpine.

According to the *Pharmaceutical Journal*, a singular action of pilocarpine has recently been made known by Dr. G. Schmitz, of Cologne. In the course of his ophthalmic practice, Dr. Schmitz had two cases in which the patients were bald, and found that after the use of subcutaneous injections of hydrochlorate of pilocarpine (with the object of causing absorption of inflammatory residue within the eye) the scalp rapidly became covered with young downy hairs. In one of these cases a man sixty years of age had his head covered in four months, partly with gray and partly with black hairs of considerable growth, so as quite to hide his previous baldness. If this stimulant action on the hair bulbs be proved to generally follow the use of jaborandi or its alkaloid (pilocarpine) a rapid increase in the demand for the latter may soon be expected.

A SPRINKLING of lime, plaster, or sulphur over the leaves of the strawberry at the first appearance of the blight, is suggested as a remedy for this disease, which has made such sad work with the foliage of this delicious berry.

ENGINEERING INVENTIONS.

An improved pump, having a hollow piston provided with valves, connected with the supply and discharge pipes, and having a cylinder which is reciprocated by a lever handle, has been patented by Messrs. J. Y. Wren, C. Wren, and G. R. Wren, of Plymouth, Pa.

Mr. James L. D. Wolfe, of Windsor, Nova Scotia, has invented an improved ship's pump, in which the piston is reciprocated by a right angled lever operated by a grooved cam.

An improvement in sharpie boats has been patented by Mr. T. Clapham, of Roslyn, N. Y. It is provided with an attachment piece arranged below the water line, and extending from the stem to amidships, to prevent spanking and to enable the boat to always go "in stays."

An improved machine for making open ditches for tile drains and other purposes has been patented by Messrs. James A. Grant and Thomas McClelland, of Mount Pleasant, Ohio. It is mounted on wheels, and operated by drawing it along in the field like an ordinary wagon.

Mr. John McLucas, of Redfield, Iowa, has patented an improved turbine water wheel, which may be arranged on either a vertical or horizontal shaft. It is provided with peculiar chutes and buckets, which cannot be clearly described without an engraving.

ROWELL'S IMPROVED LENS FOR SPECTACLES.

We illustrate herewith an improvement in lenses for spectacles, recently perfected and patented by Mr. J. R. Rowell, of Hill, N. H. Although the improvement is very simple in its character, it is said that it makes a wonderful difference in vision. The lens has two foci, and is therefore capable of forming two distinct images. This peculiar feature will be more readily understood by reference to the engraving, in which Fig. 1 shows the lenses complete mounted in a spectacle frame in the usual way.

In Fig. 2 is shown a diametrical section of the lens, and the direction of the light rays is shown by dotted lines. Fig. 3 is a diametrical section of an ordinary lens.

It will be noticed that in the improved lens the central portion is of long focus, converging the rays at *a*, while the annular portion is of comparatively short focus, converging the rays at *b*.

Mr. Rowell tells us that this lens is adapted to any eye that would be suited by an ordinary lens focusing at any point between *a* and *b*, and that it requires only five sizes, or five different lenses, to fit all eyes met with in the ordinary practice of the optician.

Another feature claimed by the inventor as important is that the field of vision appears to be amply illuminated, and that vision is far more distinct than with ordinary lenses.

The Black Mildew of Walls.

At a meeting of the Philadelphia Academy of Natural Sciences, September 3, Professor Leidy remarked that in Hardwicke's "Science Gossip," there is an article by Professor Paley entitled "Is the Blackness of St. Paul's merely the Effect of Smoke?" According to the author of the article, the blackness is mainly due to the growth of a hitherto undescribed lichen, which appears to flourish on limestone and in situations unaffected by the direct rays of the sun. Professor Leidy said that his attention had been called a number of years ago to a similar black appearance on the brick walls and granite work of houses in narrow shaded streets, especially in the vicinity of the Delaware river. Noticing a similar blackness on the bricks above the windows of a brewery, from which there was a constant escape of watery vapor, in a more central portion of the city, he was led to suspect that it was of a vegetable nature. On examination, the black mildew proved to be an alga, closely allied to what he supposed to be the *Protococcus viridis*, which gives the bright green color to the trunks of trees, fences, and walls, mostly on the more shaded and northern side, everywhere in the vicinity of Philadelphia. It may probably be the same plant in a different state; but, until proved to be so, may be distinguished by the name of *Protococcus lugubris*. It consists of minute round or oval cells, from 0.006 to 0.009 mm. in diameter, isolated or in pairs or groups of four, the result of division; or it occurs in short, irregular chains of four or more cells up to a dozen, occasionally with a lateral offset of two or more cells. The cells, by transmitted light, appear of a brownish or olive-brownish hue. In mass to the naked eye the alga appears as an intensely black powder.

CATILLON, a French physiologist, found that the addition of from seven to eight grains of glycerine to the daily ration of a lot of Guinea pigs increased the effect of their food so that they gained from one-tenth to one-fifth of their weight in a given time, while a second lot fed on the same ration, but without glycerine, gained nothing; when the dose of glycerine was changed to the second lot they gained in weight, and the first lot gained nothing. Large doses of glycerine, however, cause derangement of the digestive organs.

THE EXPLOSION ON THE THUNDERER.

The bursting of the 35 ton gun on the British war vessel Thunderer, during target practice on the morning of 2d of January last, with the attendant loss of life, was widely noticed at the time.

From the report of the joint committee appointed by the Admiralty and War Office to inquire into the cause of the disaster, it appears that the two guns of the fore turret of the Thunderer and the two guns of the after turret were each loaded with a battering charge of 110 lb. and with an empty Palliser shell. In the case of the fore turret disk wads were used; but in that of the after turret (where the guns, being only of 35 tons weight and of 3 feet less length than those of the fore turret) the guns were loaded by hand from within the turret, and wads were not used, the water being smooth and the guns horizontal. All four guns, being primed with electric tubes, were coupled up electrically so as to be fired from the "conning tower," to deliver what is known as an electric broadside. The target at this time was about 400 yards distant and the ship was under steam. On the firing key being pressed to fire this broadside, although the tube of the right gun in the after turret was exploded by the electricity, the fire was not communicated to the powder in the cartridge, and that gun admittedly made a misfire. The committee have been forced to the conclusion that the left gun of the fore turret also missed fire. After the electric broadside the order was given for independent firing with empty common shell and full 85 lb. charges. Both guns of the fore turret were thus loaded. The right gun was then fired independently; the left gun of the fore turret was then fired

the battering charge would be ignited by the tube, and the flame from this, before the expansion of the 'gas check' fully took place, passing forward would almost instantly ignite the full charge. At that time, however, the ignition of the battering charge would have driven the Palliser shell forward, and have violently compressed the full charge in front of it, and probably have driven it somewhat forward in the gun, and thus the point of maximum effort of the exploded compressed full charge would have been just about in the center of the 1 B coil—namely, 90 inches from the breech end of the bore. An explosion of 85 lb. of powder thus compressed and having a shell in front of it occurring in this place would unquestionably be sufficient to burst the gun."

That the second charge was exploded by fire from the first, Prof. Osborne Reynolds thinks highly improbable. In a paper read before the Manchester Philosophical Society he pointed out that the bursting of the gun like a shell in front of the first shoulder implied an enormous excess of pressure at this point of the gun, an action such as might result from guncotton or dynamite, but which could not be produced by the slow burning of pebble powder.

The reason why guncotton is so much more destructive than gunpowder is not that it gives off more gas, weight for weight, but that when ignited by a flash it burns so much quicker. If, therefore, by any means the whole mass of gunpowder in the forward charge had been heated up to the firing point at the same instant, so that the grains fired simultaneously inside as well as out, the action of the powder would have been as quick or quicker than the guncotton. And, still further, if besides being heated the powder was

compressed into a fraction of the space it usually occupies, the gases so confined would have been capable of a still greater pressure.

That this was the real condition attending the explosion Prof. Reynolds showed to be altogether probable. He said:

"Now if the after cartridge were fired and the forward cartridge were not ignited by the flash, and considering the length and fit of the shot, it could hardly have been so ignited, then the after shot would be driven forward, closing on to the forward shot and compressing the powder between until the pressure on the forward shot was at least half as great as the pressure of the gases behind the after shot, which would be between ten and twenty tons on the square inch. Thus the powder would be subjected to a squeeze between the two shot such as would result from a blow. It would be compressed to a fraction of its former volume. The cubes would be crushed into a cake and the work of compression would be sufficient to heat the powder beyond its point of ignition. Thus the entire mass of powder would be

simultaneously ignited in a highly compressed and heated state. The force of such an explosion would be practically unlimited and would be located at the very point at which the gun burst. Hence in such an action we have ample cause for the effect produced."

To test this theory of the explosion Prof. Reynolds suggested that a 12 inch gun be loaded with a double charge of powder and a double charge of shot, or a shot of double weight, and fired. If, as was probable, the gun did not burst, confidence in the gun would be re-established. Then let the gun be loaded twice over with the powder between the shot so as to ascertain whether the action of the powder when fired by percussion would not produce an effect similar to that which caused the explosion. "The destruction of one gun for the purpose of establishing confidence in all the rest," Prof. Reynolds added, "would not seem to be an unworthy sacrifice."

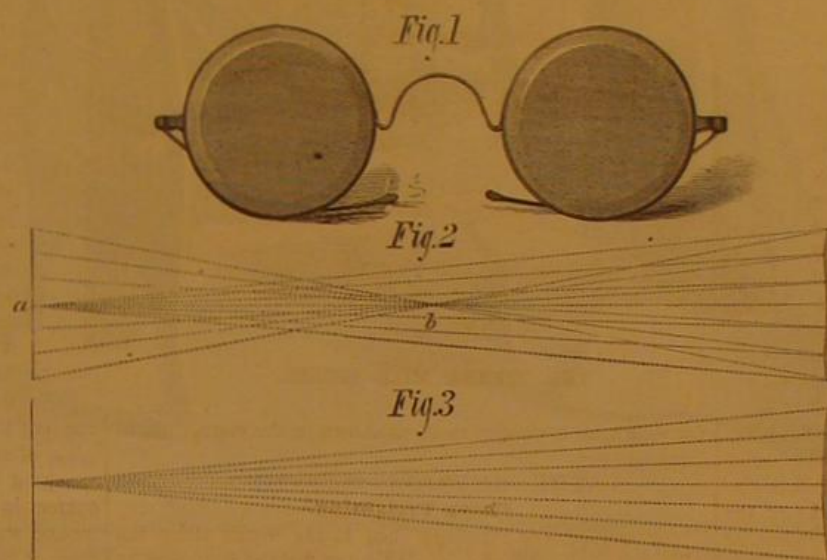
Geological Survey of Kentucky.

We have received from the Director of the Kentucky Geological Survey, Prof. N. S. Shaler, the following reports: On the Timber Trees of the Tradewater Region, by L. H. De Fries; On the Timbers of the Purchase District, by the same; On the Cumberland River (Limonite) Iron Ores, by Wm. B. Caldwell, Jr.; On Coal Washing for the Separation of Coal from its Impurities, by P. N. Moore.

These reports, particularly the two last named, will be found of value to all interested in the development of the resources of Kentucky. The limonite ores of this State are not only abundant, but particularly valuable for steel making. Coal of excellent quality abounds in the same region.

Antwerp Industrial Exhibition.

Mr. James R. Weaver, United States Consul at Antwerp, informs the Department of State that an industrial exhibition will be opened in Antwerp in August, 1879, which will be worthy of universal attention. Space has been allotted for American products. The consul commends the exhibition to the artisans and producers of the United States. Correspondence may be opened with and consignments sent to S. H. Haine, No. 39 Rue Honblonniere, Antwerp, Belgium, who will take charge of American goods. He has already received a number of consignments to his care from the United States. Goods should be in Antwerp before the first day of August next.



ROWELL'S ANNULAR FOCUS LENS FOR SPECTACLES.

AN IMPROVED MANGLE.

The principal hindrance to the general introduction and use of mangles in this country has been their cost and their complicated nature. In Europe, notwithstanding the objections, these machines are quite generally used and their utility is acknowledged.

The novel mangle shown in the accompanying engraving is the invention of Mr. Charles Reese, of 345 Madison avenue, Baltimore, Md. It seems to be a marked improvement in this class of machines, as it is without gearing and its parts are few and simple. The iron end pieces or standards support a concave bed, above which a convex presser block is suspended from a shaft at the top of the frame. This shaft may be raised or lowered by means of the lever that projects over the front of the machine. A suitable handle is attached to the front of the presser block, and between the presser block and the bed is placed a roller, around which the cloth to be mangled is wrapped.

The bed and presser may be made either of wood or iron, or a combination of both. If the presser is made of wood it must be weighted to give the required pressure.

The cloth to be pressed is wrapped around the roller, and the presser is raised by means of the lever at the top of the machine. The roller is inserted between the bed and the presser, the latter is let down upon the roller, and the cloth is pressed by swinging the presser back and forth by means of the handle.

This mangle occupies less space than other forms, and is cheaper, and it is claimed that it will do better work with less labor.

The inventor says that the arms which support the presser block may be extended even to the ceiling of the kitchen or laundry, and that the machine may be made a permanent fixture in the house.

This machine has been patented in this country, also in Canada, England, France, Germany, and Belgium. Any further information in regard to it may be obtained by addressing the inventor as above.

AN IMPROVED EMERY WHEEL STAND.

The saving of files and tools by the use of solid emery wheels, amounting as it does to thousands of dollars annually, is an item to be considered by manufacturers of iron and steel articles. There are few manufacturers of this class who could not in one way or another make use of solid emery wheels, and whatever tends to augment their usefulness will be readily appreciated. In the ordinary emery wheel stand considerable difficulty is experienced from the escape to the periphery of the wheel of the oil used in lubricating the mandrel. To avoid this, Messrs. Shoener & Allen, of 328 Walnut street, Philadelphia, Pa., have devised a concave grooved clamp—the construction of which will be readily understood from the engraving—which flings off the waste oil escaping from the journals and prevents it from creeping upon the stone. The machine has a broad and solid base, and the parts are arranged with a view to the greatest convenience. We are informed that the utmost care is taken in their manufacture; the arbors being of steel well fitted, and the boxes being hand reamed after being placed, to secure perfect alignment, and all of the pulleys are carefully balanced. Any further information in regard to this machine may be obtained from the manufacturers as above.

A Dakota Wheat Farm.

The largest cultivated wheat farm on the globe is said to be the Grondin farm, not far from the town of Fargo, Da-

kota. It embraces some 40,000 acres, both government and railway land, and lies close to the Red River. Divided into four parts, it has dwellings, granaries, machine shops, elevators, stables for 200 horses, and room for storing 1,000,000 bushels of grain. Besides the wheat farm, there is a stock farm of 20,000 acres. In seeding time 70 to 80 men are employed, and during harvest 250 to 300 men. Seeding begins about April 9 and continues through the month, and is done



THE RHYSTON MANGLE.

very systematically, the machines following one another around the field, some 4 rods apart. Cutting begins about August 8, and ends the fore part of September, succeeded by the thrashing, with eight steam thrashers. After thrashing, the stubble ground is plowed with great plows, drawn by three horses, and cutting two furrows; and this goes on until the weather is cold enough to freeze, usually about November 1. There are many other large farms in the Territory and in the same neighborhood, and they are tilled in

A Curious Astronomical Phenomenon.

Under the date of April 13, Mr. Henry Harrison, of Jersey City, sends to the New York Tribune the following communication:

"At about 8:30 o'clock last evening, as I was searching for Brorsen's comet, I suddenly hit upon an object which I supposed to be a planetary nebula, very much resembling that near Beta Ursa Majoris, nearly on a line north, between the Pleiades and the variable star Algol. Being somewhat in doubt as to the existence of such a nebula in that region, I started the driving clock, noted the right ascension and declination, which were 2h. 34m. and 37° N., searched the catalogues, but found no such object recorded. By this time I found the object gone out of the field, but soon found it again, when it had gained four min. in R. A., its declination being unchanged. A half hour or so later, watching it constantly with amazement, I found it had gained the same amount. I no longer trusted to my own vision, but called a friend to confirm what undoubtedly was there. He saw it, and we both began to speculate as to its physical composition. A comet it could not be, because of its rapid motion from N. W. to S. E., nor could it have been a cloud, because it maintained not only its shape, diameter and density, but also its luminosity, and in the absence of both sun and moon a batch of cloud viewed with a telescope would have no definition, form, or illumination. Still following it as it slowly swept toward Alpha Auriga, I found that a calculation of R. A. at 9:35 was 3h. 4m., N. D. 37°.

"In order to obtain more knowledge about this wonderful phenomenon, for such I must call it, I concluded to telegraph at once to the Naval Observatory at Washington to set the circles, as I calculated, about 7h. 8m. west of the meridian and declination north 37°, which position it would occupy by the time the message would reach the observatory. Returning from the telegraph office at 10:45, its altitude must have reached a height of 40°. Still it maintained its form and brilliancy. I must say here, that before sending a dispatch to the Naval Observatory, I thought that the object might be a reflection, but this thought was rapidly removed by placing a pasteboard tube of eighteen inches in length over the objective, but onward it moved with independent motion. Even the two-inch finder showed it faintly. At 10:45 I noticed its declination to be 37° 6'; at 11:30 it neared the double star Alpha Gemini, and rapidly passing before a star of the sixth or seventh

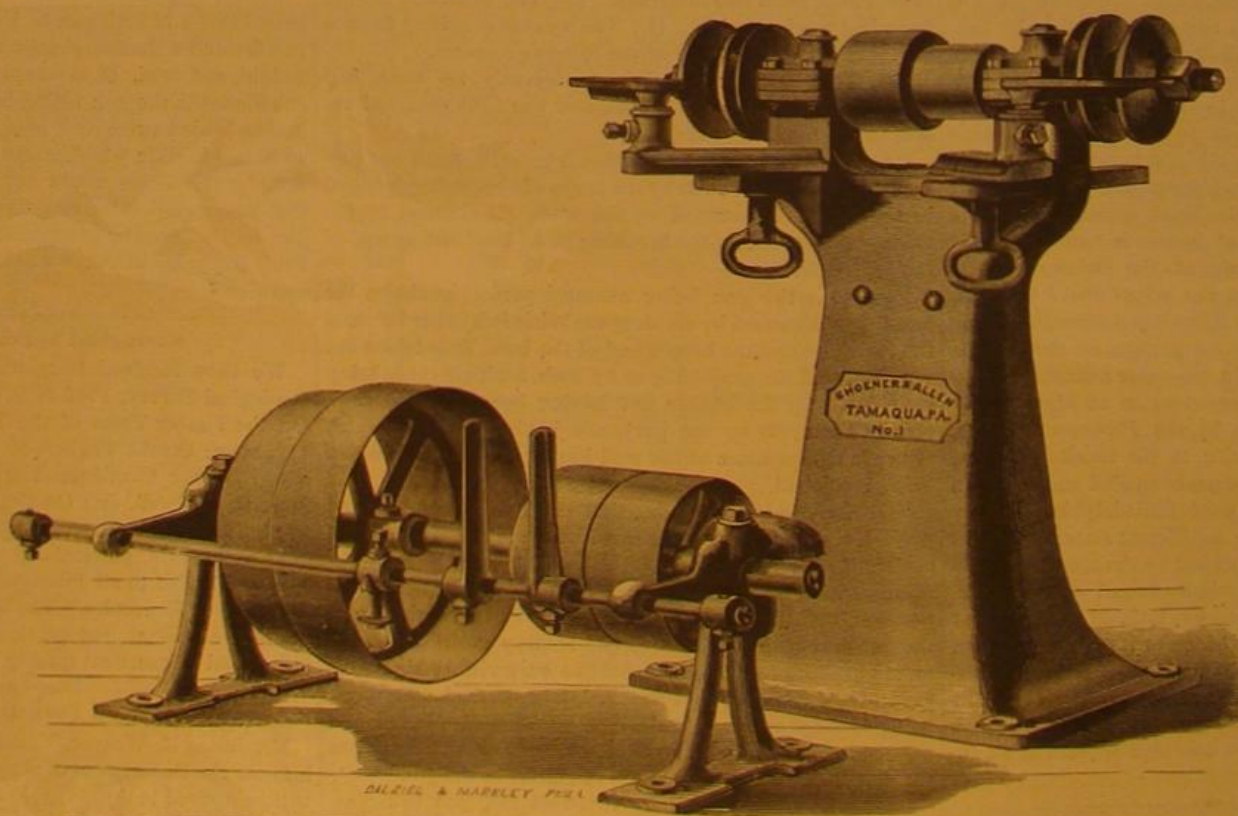
magnitude, seemed not to obscure the latter, but showed the star almost as brilliant as immediately after its passage. The declination now was 37° 28'.

At 12 o'clock I retired for a short time, after a wearisome chase of nearly three and a half hours. At 2:10 o'clock this morning I found it, after a search of about twenty minutes, in the zenith. It now seemed to be more brilliant than at any previous observation, its declination being now 37° 40', and I fancied I could see it with the unaided eye, but cannot be positive of this. I must confess, although absurd, the thought entered my mind that one of the planetary nebulae, tired of its position, was seeking another and a better home."

The Mirror Telegraph.

Mr. H. Baden Pritchard contributes to *Nature* an interesting account of the use made of the heliostat by the English in their campaigns in Afghanistan and Zululand. It is

claimed that this is the first application of the mirror as an implement of warfare. Heliostat stations, says Mr. Pritchard, are now established throughout the Khyber Pass, and General Sir Samuel Browne, at Jellalabad, has his orders passed up to him by flashes of light from Peshawur and Ali Musjid. Lord Chelmsford has of late also been furnished



SHOENER & ALLEN'S EMERY WHEEL STAND.

much the same manner as the Grondin. The surface of the land generally is almost level, and the soil rich and black. The product of one field of 2,315 acres is 57,285 bushels—elevator weight—some 25 bushels to the acre. The average yield of the Dakota wheat farm is 20 to 25 bushels per acre.

with heliostats, in order to provide him with better means of communication along the Tugela. The plan of working is very simple. The mirror of the heliostat is placed so as to reflect the sun's image to a distant station, and when the instrument has once been set, the clockwork arrangement suffices to maintain the mirror in its proper position. In this way the distant station in question always sees the dazzling ray reflected from the mirror, except when the latter is purposely obscured. The appearance and disappearance of the bright spot or flash constitute the signals. There is no need for any superintendence when once the apparatus has been put in working order, and a trained signalman suffices for the duty. The ordinary Morse alphabet supplies an intelligible code, and no one out of the line of signals can read or understand the message. As a substitute for the dot and dash, which go to make up the ordinary written Morse code, the light is shown for short and long intervals; thus the light shown for a short period followed by a long period signifies A, while B is represented by a long period followed by three short ones; in the case of C, long, short, long, short signals are made in turn, and to form E (the letter most frequently used), the light is permitted to shine for one single short period only. The intensity of these sunshine signals can scarcely be imagined by any one who has not seen the heliostat in working order, and the distance to which they might be made to travel, could suitable stations be provided, is practically unlimited. The appearance or non-appearance of the light can be noticed at ten or twenty miles distance without the aid of telescope or field glass.

Postal Zoological Garden.

German post offices are zoological gardens on a small scale. According to the *Tribune*, in the course of a year as many as 40,000 live animals are sent by post, and if crabs, frogs, bees, and small insects are counted, the total will be among the millions. The post office authorities have the privilege of excluding such animals as may be deemed either dangerous or disagreeable; but within the last six months, only 39 packages of living animals were refused, among which were an alligator, done up in a box considered as too fragile; a lot of dogs, whose persistent barking could not be quieted; and a number of pigeons loosely tied up in a sack. On the other hand, during the same period, a crocodile, scores of birds of prey, monkeys, serpents, a leopard, and four living bear cubs were transmitted by post.

PROFESSOR PANCOAST has been exhibiting and explaining the Carolina twins to the students of the Jefferson Medical College, Philadelphia. They are the pair who have been widely shown as a two-headed girl. The professor considers them far more wonderful than the Siamese twins, who were two distinct persons, while these negro sisters have a single back bone below the shoulder blades, at which point the spinal column branches like the arms of a letter Y. They were back to back at birth, but in learning to walk they twisted themselves to facilitate locomotion, and now stand nearly side by side. Experiments showed that when either was touched below the point of union both felt it, but above that point there was a separate sensitiveness. Dr. Pancoast thinks they will die simultaneously.

THE WINDOW GARDEN.

Nothing adds more to the cheerful appearance of the interior of a house than an array of choice plants, but too frequently it happens that the hideous red pots containing them are permitted to stand out in bold relief, entirely neutraliz-



THE WINDOW GARDEN.

ing the pleasurable effect of the plants. Our engraving shows a beautiful plant stand, or window garden, which may receive the earth in which the plants are rooted, or the pots may be placed in it and hidden by it. The fish in the globe at the top give it life, and the whole forms a beautiful ornament for the window.

THE YAK.

The yak, or grunting ox, derives its name from its very peculiar voice, which sounds much like the grunt of a pig. It is a native of the mountains of Thibet, and according to Hodson, it inhabits all the loftiest plateaus of High Asia, between the Altai and the Himalayas.

It is capable of domestication, and is liable to extensive permanent varieties, which have probably been occasioned by the climate in which it lives and the work to which it has been put. The noble yak, for example, is a large, handsome animal, holding its head proudly erect, having a large hump, extremely long hair, and a very bushy tail. It is a shy and wilful capricious animal, too much disposed to kick with the hind feet and to make threatening demonstrations with the horns, as if it intended to impale the rider. The heavy fringes of hair that decorate the sides of the yak do not make their appearance until the animal has attained three months of age, the calves being covered with rough curling hair, not unlike that of a black Newfoundland dog. The beautiful white bushy tail of the yak is in great request for various ornamental purposes, and forms quite an important article of commerce. Dyed red, it is formed into those curious tufts that decorate the caps of the Chinese, and when properly mounted in a silver handle, it is used as a fly flapper in India under the name of a chowrie. These tails are carried before certain officers of state, their number indicating his rank.

The plow yak is altogether a more plebeian-looking animal, humble of deportment, carrying its head low, and almost devoid of the magnificent tufts of long silken hairs that fringe the sides of its more aristocratic relation. Their legs are very short in proportion to their bodies, and they are generally tailless, that member having been cut off and sold by their avaricious owner. There is also another variety which is termed the Ghainorik. The color of this animal is black, the back and tail being often white. The natives of the country where the yak lives are in the habit of crossing it with the common domestic cattle and obtaining a mixed breed. When overloaded, the yak is accustomed to vent its displeasure by its loud, monotonous, melancholy grunting, which has been known to affect the nerves of unpracticed riders to such an extent that they dismounted, after suffering half an hour's infliction of this most lugubrious chant, and performed the remainder of their journey on foot.

William Kingdon Clifford.

The scientific world has recently sustained another heavy loss in the death of Prof. William K. Clifford, which occurred at Madeira on the 4th of March. Prof. Clifford, one of the deepest thinkers and most brilliant writers of the present century, was the eldest son of the late Mr. William Clifford, an Alderman of Exeter, England, and was born on the 4th of May, 1845.

He received his earlier education at the school of Mr. Templeton in his native city, and from thence proceeded to King's College, London. Here he gave evidence of his great intellectual powers by shortly obtaining high honors, taking in his first year, 1861, the Junior Mathematical and Junior Classical Scholarships and the Divinity Prize. In the two succeeding years he gained the Classical and Mathematical



THE YAK.

Scholarships of the year, and in addition to the Inglis Scholarship for English language, an extra prize for the English essay.

Shortly after taking his degree he was elected a fellow of his college, and filled the post of assistant tutor until his election to the chair of Applied Mathematics and Mechanics at University College, London, in August, 1871, a position which he held until his death. He was elected a Fellow of the Royal Society, June, 1874.

Prof. Clifford was distinguished not only for his rare talent for mathematics, but for a remarkable capacity for bringing the most advanced scientific ideas within the range of ordinary knowledge. His "Analogues of Pascal's Theorem" was written while he was still in his eighteenth year, and constitutes the first of his papers recorded in the Royal Society's catalogue. "Analytical Metrics," one of his longest and most fully worked out papers, published in the *Quarterly Journal of Mathematics*, was written in his nineteenth year. At the Royal Institution, on March 6, 1867, he addressed a large public audience for the first time, the subject of his lecture being "Some of the Conditions of Mental Development." Among his auditors on this occasion were some of the leading thinkers of the time, and from that day he took a recognized place among them. His remarkable power of explaining some of the most difficult physical conceptions to a popular audience was well exhibited at a subsequent date, on the occasion of a delivery, at St. George's Hall, of a series of lectures on subjects such as "Ether," "Atoms," and "The Sun's Place in the Universe."

The position taken up by Prof. Clifford in philosophy was never comprehensively defined by himself, but must be collected from his numerous papers and lectures of the last few years. In pure metaphysics may be specified articles on "Body and Mind" (*Fortnightly Review*, 1875), and the "Nature of Things-in-Themselves" (*Mind*, 1878); in ethics, "The Scientific Basis of Morals" (*Contemporary Review*, 1875), "Right and Wrong" (*Fortnightly Review*, 1876); and in the application of ethical theory to social and religious questions, "The Ethics of Belief" (*Contemporary Review*, 1876), "The Bearing of Morals on Religion" (*Fortnightly Review*, 1877), and an article on Virchow's address on the freedom of science (*Nineteenth Century*, 1878).

He was unmistakably one of the foremost English mathematicians of our day, and had he lived would have done much more to maintain that position; but a constitution naturally weak gave way to too close attention to his favorite studies, and the dread disease, consumption, cut short a brief but brilliant life.

ARTIFICIAL LIGHTING FOR PHOTOGRAPHY.

The subject of artificial lighting in the portrait studio is attracting much interest in England.

Three methods are employed for producing a highly actinic light suitable for the purposes of the photographer—the electric, the pyrotechnic, and that produced by the combustion of magnesium wire. Each of these lights has its special disadvantages, and for each the excellence of the results depends far more upon the arrangements for using the light than upon the light itself. And the arrangements which answer best with one light are apt to be wholly unsuited for use with any other light.

The great difficulty with electric light, next to its excessive cost, is to secure a sufficient diffusion of the rays, and to subdue their intense brilliancy without too great a loss of actinic power. A method of burning pyrotechnic compound in a paper case, whereby a larger illuminating surface is produced, gives, it is said, much better results. In the electric light the rays proceed from a point, diverge rapidly, and as rapidly lose illuminating power. Thus an electric light with six minutes' exposure failed to give anything but the most brightly lighted points of the picture, when the same light, used with an imperfect reflector, gave a better result in two minutes. With the pyrotechnic compound burned in case, or, better, in a saucer, the rays proceed from a surface of considerable extent, and are less divergent; hence at a given distance from the light the loss is much less than with the electric light. When the latter is used with a translucent screen covering the front of the reflector it shows an intensely brilliant center, surrounded by a circle less brilliant and curiously variegated by a network pattern caused by reflections; while the space between it and the center appeared quite dark in comparison. With the pyrotechnic light the screen is evenly illuminated, and no light is lost.

When used with an apparatus called the luxograph the results obtained are said to be very fine. The luxograph is described as a slightly conical metal cylinder resembling a kettledrum, nearly six feet across. The drumhead, so to speak, is made of a peculiar paper charged with a mineral which increases the dispersing power of the screen. The interior of the cone, or drum, is lined throughout with small mirrors, making it a powerful reflector. In the center of the back is a square lantern of blue glass, of three different tints, open at the top. The pyrotechnic powder is burned in the lantern. When the combustion has reached its height the sitter's face is flooded with a soft violet light of the most diffusive and actinic character. The fumes of the pyrotechnic compound and the brevity of the combustion are its chief disadvantages.

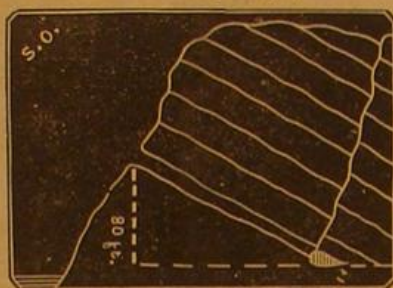
The best magnesium light is said to be produced by the lamp made by Mr. A. Brothers, of Manchester. It consists of an arrangement by which three ribbons of magnesium are burned at once, and the light thrown upon the sitter by parabolic reflectors. The great objection to it is the cost of operating it.

In a communication to the Edinburgh Photographic Society, Mr. Thomas W. Drinkwater expresses the conviction that the method of the future will employ coal gas. As gas is ordinarily burned, the light lacks both power and activity; but when the gas has been fortified by the addition of hydrocarbons, or, more especially, when the much lauded Sugg burner is used, an extremely brilliant, cheap, and easily managed light for photographic purposes is said to be attainable. To this process, however, the crucial test of practical use does not appear to have been applied.

In England, with its dull and foggy climate, not to speak of the chronic sunlessness of London, the question of artificial illumination for portraiture is of real and practical moment. In our sunny climate it partakes more of the character of an advertising novelty. Nevertheless it may not prove an unprofitable field for experimental work even here.

FORMATION OF ICE CAVES.

In the *SCIENTIFIC AMERICAN* for March 29 last, there appeared a letter from Mansfield, Ohio, inquiring as to the cause of the phenomena in an ice cave which is to be found in Decorah, Iowa, and for which there appears to have been, as yet, no cause assigned. A description of this cave is given in the same letter, of which description, so nearly as is possible, the accompanying illustration is a fair representation, as regards the main features of the case. There may be a few differences as regards the details of the cave, but so nearly as can be judged from the written description, the drawing presents the elements necessary to the peculiarities of the cave. In the figure, the cave will be seen represented as at the bottom of an inclined passage, the inclination being



that noted in the description, and the dimensions and other particulars being as nearly as possible to the proper scale. The crevice, mentioned in the description, may be imagined as a fault, which extends from the top of the cave to the top of the bluff, through which crevice mingled air and water find their way to the cave.

In regard to the mingling of air with a stream of descending water, a quotation from the pamphlet of Mr. Frizzel, on the subject of the compression of air by such streams, would not be entirely out of order. On this subject, he says:

"It is a matter of common observation that bubbles of air rise in still water with a very moderate velocity. The velocity depends, somewhat, on the size of the bubbles. Bubbles, such as issue from an orifice one eighth or one tenth of an inch in diameter, rise from a depth of fifty feet in about fifty seconds, moving rather less than one foot per second near the bottom, and rather more than that near the surface. It is plain that a bubble of air drawn into water that has a downward motion of more than one foot per second, will be carried down and subjected, in its descent, to a continually increasing pressure."

Considering, then, the description and the facts above quoted, it would not be unfair to assume that there would be a possible compression of air contained in the water, on its liberation in the cave, of about eighty pounds to the square inch. This assumption is supported by the fact that from the description, the mouth of the cave would be at least eighty feet above the level of the river, and it may be inferred that as no special mention is made on the position of the entrance, save that it is in the side of the bluff, the hill may be considered as extending above the mouth of the cave to at least the distance of the latter from the river.

The phenomenon, then, of ice being found there in the summer, can be referred, I think, to the theory of the liberation of compressed air brought down from a considerable height by a stream of water falling or flowing through a natural conduit or fissure in the rock, embodying the principle of the ancient and well known tromp used in the Catalan forge, and still in use in Corsica, Sardinia, Savoy, and many other places.

It is only necessary to imagine such imperfection in the conduit or fissure at the initial point, which is supposed to be on the top of the bluff, or far up the mountain's side, as would admit air to come in contact with the water after it had attained a velocity of more than one foot a second. When the air has reached the bottom and is liberated in the cave, it will be from a pressure equal to the height of the column of water, and it will have lost by convection in the mass through which the conduit passes, the heat due to its compression; and on being liberated, it will immediately absorb from the air and the water in the cave, the heat which it has lost in its downward passage.

"The most remarkable fact," that the cave freezes only in summer, and as the cold of actual winter comes on, the ice in the cave gradually melts and disappears, is caused, I will venture to state as an opinion, by the gradual freezing of the surface at the top of the bluff or the source of the air, to a considerable depth, thus sealing up the aperture through which the air entered the conduit.

Sir Roderick Murchison described a similar ice cave at Lletaki, Russia, but gave no explanation as to the phenomena.

Ice wells are to be found at the foot of Mount Mansfield, in Vermont, and are really incipient caves, without depth enough to be clear of ice in winter, from the fact that the external winter temperature reaches the bottom or source of the summer ice.—N. M. Loeve, in *Science Observer*.

Correspondence.

The Brush Electric Light.

To the Editor of the *Scientific American*:

In notes on "Electric Lighting," March 1, you mention the fact that the makers of the Brush machine claim to be able to produce 17 or 18 lights from one machine with an expenditure of 13 to 14 horse power, adding: "This statement, however, should be accompanied by accurate tests, which do not appear to have been made." We desire to correct the impression conveyed by referring to the actual performance of several machines sold by us and in regular industrial use to-day. One of these is at the Merrimack Mill, Lowell, Mass.; one at the Conant Thread Company, Pawtucket, R. I.; two at the Riverside Mill, Providence, R. I.; two at the immense retail establishment of John Wanamaker, Philadelphia, Pa.

All of these machines are of same size and power, and the average of over twenty tests of power absorbed by them, taken with a dynamometer, was $13\frac{5}{100}$ horse power. Each machine furnishes 16 to 17 lights, each of 2,000 candle power, and all the lamps are placed in series on one circuit.

We are not aware that any other system of electric lighting known or described to-day can produce the result above shown. It certainly very far exceeds in economy and efficiency the Gramme-Jablochkoff system in use in Paris and London, and we do not see that Rapieff, Werdermann, Lontin, De Meritens, or any others, have actually done as much as they have.

We have just closed a contract for the lighting of Monument Park, in this city, with the Brush electric light. We displace 105 gas lamps, six-foot burners, with 12 Brush lights, and the cost to the city is considerably less than has been paid for the gas lamps, and we shall furnish not less than double the light they did.

We advertise regularly in no paper but the *SCIENTIFIC AMERICAN*, and have not endeavored to create a "newspaper furor" regarding our light—à la Edison, Sawyer, et al.; yet we have sold for actual industrial use in this country, within one year, over 200 Brush lights, and we are running our factory night and day on orders for similar purposes.

Regarding the use of electric light in dwellings, or on a small scale, we all agree with Mr. Brush, that there is as yet nothing before the public, here or abroad, which promises success in this direction.

Mr. Brush is aiming simply to produce the greatest possible number of powerful steady lights from one machine in one circuit with the least expenditure of power. Have you any record of results equal to his?

G. W. STOCKLY,
Vice-President Telegraph Supply Company,
Cleveland, Ohio.

A CHANCE FOR INVENTORS.

The Secretary of the Treasury has constituted a board, consisting of Captain Forbes, manager of the Massachusetts Humane Society; Captain Moore and Lieut. Sparrow, of the Revenue Marine Service; together with Mr. B. C. Sparrow and Captain Patterson, of the Life Saving Service, to investigate all plans, devices, and inventions for the improvement of apparatus for use at life saving stations, which may appear meritorious and available, and to examine and test as far as practicable all such as may be submitted by the general superintendent, and to make detailed reports of the results of the investigations and tests for his information. The scope of the board embraces action upon all devices for the improvement of life saving apparatus intended to be used at the life saving stations, except wreck ordnance and its immediate appurtenances, which will be referred to a board composed of experts in gunnery, and two practical surfmen to give them aid upon points connected with the actual wreck service. Devices intended to be carried on board ship do not fall within the scope of the action of the board, as this class of life saving apparatus is taken cognizance of by the steamboat inspector's service. Capt. Forbes has been designated president, and has been directed to call a meeting of the board as early as practicable, as there are already on hand several inventions to be examined. Persons wishing to have their inventions submitted to the board may address Mr. S. I. Kimball, Superintendent of the Life-Saving Service, at Washington, D. C.

Beatty Organs and Pianos.

When a manufacturer is willing to send expensive wares to a distance at his own risk for trial, and to pay freightage both ways in case of rejection, it is evident that he has no lack of confidence in the intrinsic merit of what he has to sell. When he finds the practice a profitable one, the evidence is quite as strong that the articles offered are worthy of their maker's confidence in them, and that their rejection is not apt to occur.

The offer made in our advertising columns by Mr. D. P. Beatty, organ and piano manufacturer, Washington, N. J., tells its own story. Within a few years Mr. Beatty has built up a large and successful business; and by dealing directly with the users of his pianos and organs, avoiding agents' fees and profits, he is able to furnish superior articles at extremely low rates.

AN ELEGANT CABINET.

When, under the reign of Louis XVI. (towards 1780), the true principles of art began to prevail again, the degenerated and capricious forms of the preceding epoch, under the Régence and Louis XV., disappeared gradually to make room for straight forms of a purer character, suggested by the revival of classical art. Nowhere more than in cabinet work and furniture do we remark this new tendency: classical entablatures replace the contorted forms of the Rococo; caryatides, acanthus leaves, and enriched mouldings in ornate plaques of porcelain, painted with pastoral scenes and flowers, cameo medallions in porcelain and glass, are introduced instead of the confused scroll work and unmeaning decoration of the style of Louis XV. The artistic treatment, although somewhat dry and stiff, contrasts agreeably with the unconstructive and degenerated forms of the preceding period; its deficiencies are partly due to the application of cast metal ornament, which replaced almost entirely the carving in wood, partly to the taste and fashion of the time.

The piece of furniture represented here belongs to this style of art, and shows rich ornaments in bronze gilt and inlaid plaques of Sèvres porcelain, *pâte tendre*, with bouquets of flowers.*

Marine Silk.

Among the many novelties which industry obtains from the sea, one of the most curious is the textile product made with the "byssus" of the *Pinna* of the Mediterranean—the "fin shells" or "sea-wings," as they are called. The species are the *Pinna nobilis*, *P. rugosa*, etc.

The shells, which are usually very fragile, resemble in form those of the larger species of muscles, being long and tapering, narrow at the back, and gradually expanding to a considerable breadth toward the opposite extremity. There are some twenty or more species of the genus, which produce in large quantities a very fine sort of silky byssus or braid. It is called by the fishermen *lana pinna*, or fish wool. These bivalves are provided with a tuft of delicate fiber, which cannot be better compared than to fine hair or silk, or spun glass; with this they attach themselves to the rocks, living continually under water. The ancients made this material an article of commerce, greatly sought after, and the robes made from it, called "tarentine," were held in great esteem. It is said that the scarf of the turban of Archytas was made of this fiber. In the year 1754, a pair of stockings, made of it, were presented to Pope Benedict XV., which, from their extreme fineness, were inclosed in a small box about the size of one for holding snuff. A robe of this material is mentioned by Procopius as the gift of a Roman Emperor to the satrap of Armenia.

Even in the present day the fiber is utilized, but more for its rarity than anything else. The women comb the *lana* with very delicate cards, spin it, and make from it articles which are much esteemed for the suppleness of the fiber, and its brilliant burning gold luster. In Italy the poorer girls and women make from it purses, necklaces, ear rings, etc., and it thus proves a no mean source of income to hundreds of families. A considerable manufactory is established at Palermo; the fabrics made are extremely elegant, and vie in appearance with the finest silk. The best products of this material, however, are said to be made in the Orphan Hospital of St. Philomel, at Lucca.

At both the London and Paris Exhibitions there were shown shawls, stockings, gloves, etc., made of the material. This byssus forms an important article of commerce among the Sicilians, for which purpose large numbers of the *Pinna* are annually fished up in the Mediterranean, by means of an

instrument called a "cramp." This is a kind of iron fork with long, perpendicular prongs, about six inches apart. Notwithstanding the extreme delicacy of the individual threads, they form such a compact tuft that considerable strength is necessary in separating the shells from the rocks to which they are attached. The tuft of silk is broken off and sold to the country women, who wash it in soap and water. They then dry it in the shade, straighten it with a large comb, cut off the useless root part of it, by which it adhered to the animal, and card the remainder. By these means a pound of coarse filaments is reduced to about three ounces of fine useful threads. This is fabricated into va-

THE CATALPA AS A TIMBER TREE.

Nearly a year ago (July 22, 1878), the SCIENTIFIC AMERICAN noticed at great length the claims made by Mr. E. E. Barney, of Dayton, Ohio, in behalf of the catalpa as a tree worthy of general cultivation.

Mr. Barney has now published a second pamphlet, giving additional facts and information with regard to this useful tree, from which we are glad to learn that his efforts have been well rewarded. From every State and Territory in the Union many letters of inquiry have been received by him, and some also from England, South Australia, and New Zealand. What is better, quite a number of gentlemen—notably, Suel Foster, of Muscatine, Iowa; J. F. Tallent, Burlington, Iowa; and Horace J. Smith, Georges Hill, Philadelphia—have generously engaged in the work of distributing catalpa seeds, especially in the West; and the indications are that the planting of the coming season will result in some millions of trees. The growth of the catalpa is exceedingly rapid, particularly in the rich soil of the prairies.

During the autumn of 1877, the Missouri River, Fort Scott and Gulf Railroad, commenced experimental plantations of various trees on their land, near Fort Scott, in Kansas. The superintendent of the road, in his report to the president on the condition of these plantations at the end of their first year, says: "The catalpa has certainly proved to be the strongest grower, and most tenacious, standing the dry weather better than other varieties, and at present rate will come to maturity years before other varieties are of sufficient size to be of any utility." Last fall 100,000 catalpas were planted by this road. Mr. Barney says:

"I have urged the cultivation of catalpa, believing it will give the largest return in the shortest time. Its economic uses are more varied and extensive than any one tree with which I am acquainted.

"If I had a grove of common catalpa that would not be affected by the frost, I should certainly let them grow. If I wished to plant a grove of catalpa, above or below the frost line, I would most certainly plant only the Speciosa variety, as clearly better adapted to forest culture.

"I by no means ignore the fact that there are other valuable trees for forest culture—notably the white walnut or butternut, black walnut, yellow locust, red and black mulberry, Osage orange, alanthus, cherry, ash, oak, and many others, of the respective merits of which I leave others to speak.

"At the time I printed my first pamphlet I was under the impression that the examples of durability given were mostly, if not wholly, common catalpa. As it became more and more apparent, on further investigation, that the Speciosa variety was much preferable for forest planting, I felt it to be of the greatest importance to know, beyond any question, that this variety was equally durable."

The investigations made at Mr. Barney's instigation prove beyond a doubt that the Speciosa catalpa possesses the wonderful durability for which the catalpa is noted. The evidence is given at length in the pamphlet, which Mr. Barney will be glad to send to any inquirer for six cents, to cover the cost of printing and postage.

FEATHERS IN TEXTILES.—According to the Paris *Figaro*, the shops will soon have the new textiles in feathers and wool and cotton on sale. This is an invention of M. Bourguignon, of Douchery, who has found how to weave feathers (deprived of the horny substance) and incorporate them with woolen and cotton yarns in proportions varying from 10 to 75 per cent. Some very fine textiles are thus made, and especially a flannel which for warmth and lightness is unsurpassable.



CABINET IN THE ROYAL PALACE IN MADRID.

rious articles for the person, such as shawls, stockings, caps, waistcoats, gloves, etc. The web is of a beautiful yellow brown, resembling the burnished golden hue which adorns the backs of some splendid tropical flies and beetles.

A Large Orange Tree.

The *Florida Agriculturist* describes, as the biggest orange tree in that State, one at Fort Harley, near Waldo. Its height is 37 feet, circumference at top 81 feet, circumference of trunk just above ground 8 feet 5 inches. At a foot from the ground it branches into four trunks, measuring respectively 37½, 39½, 40½, and 43 inches in circumference. Each of these fork from three to five feet above ground, and again higher up. All are bare of small limbs and foliage for many feet up, except on the outer sides, so that the interior of the tree presents the appearance of a huge umbrella.

* The Workshop, Willmer & Rogers News Co. Agents, 31 Beekman street, New York city.

AN INTERNATIONAL EXHIBITION OF INDUSTRIAL SCIENCE.

An International Exhibition of the Sciences applied to Industry will be held in the Palais de l'Industrie, Paris, from July 24 till November 25, 1879.

The President of the Superior Committee is M. Cocherie, Under Secretary of State at the Ministry of Finance; the Secretary-General, M. De la Bruyère, Administrateur de la Caisse d'Épargne de Paris; and the Director, M. P. Nicole, Administrateur Général de l'Union Syndicale de Paris, who organized the Havre Exhibition in 1867, and the Exposition Maritime et Fluviale in 1875.

The scope of the Exhibition can best be appreciated from a summary of its programme, for which we are indebted to Messrs. Emile Caspar & Co., sole agents for the United States and Canada, 73 Great Tower St., London, E. C. The programme comprises 9 groups, with 69 classes, as follows:

GROUP I.—*Prehistoric Knowledge, Anthropology, and Education.*—Class 1 embraces ethnographical collections, illustrating the life of primitive man and modern savages, with specimens of prehistoric habitations, while, by way of contrast, Class 2 will contain specimens of various industries at the present day, showing the life of civilized beings in different countries. Class 3 is devoted to ecclesiastical art, and Class 4 to education and instruction, comprising schools for the deaf and dumb and blind; trade—commercial and agricultural—schools; the higher education, and apparatus and methods of instruction.

GROUP II.—*Applied Physics.*—Class 5 includes all the more recent applications of electricity, and the electric light; Class 6, the electric telegraph, with the various transmitting and receiving instruments, and the working of the telephone on telegraphic wires; Class 7, processes and specimens of electro-metallurgy; Class 8, optical instruments for both science and industry; Class 9, photography, including its new applications, and other methods of utilizing light; Class 10 (the production of heat and cold) embraces the utilization of solar and terrestrial heat, machines for making artificial ice, and for the liquefaction of gases, as well as instruments for measuring degrees of heat and cold; Class 11 (warming, lighting, and ventilation) includes fireplaces, stoves, apparatus for the use of mineral oil for domestic and industrial purposes, artificial gas and electrical illumination; Class 12 relates to hydrostatics, hydraulics, and pneumatics; and Class 13, to the production and utilization of sound, acoustic telegraph, the telephone, acrophone, and phonograph.

GROUP III.—*Applied Chemistry.*—Class 14. The manufacture of artificial products. Class 15. Bleaching, dyeing, and printing stuffs. Class 16. Chemical apparatus and cases of testing materials. Class 17. Chemical processes in glass manufacture, and specimens of various glass work. Class 18. Processes of raw materials employed in porcelain manufacture, with specimens of the various products. Class 19. Perfumery. Class 20. Pharmaceutical and hygienic chemistry. Class 21. Wall paper and imitation leather. Class 22. Leather and hides, with their applications. Class 23. Appliances and products of the India-rubber and gutta-percha trade. Class 24. Preserved foods, and apparatus for their preparation.

GROUP IV.—*Applied Mechanics.*—Class 25. Mechanics applied to the liberal arts, printing and lithographic presses, voting and writing machines. Class 26. Mechanics applied to furniture and musical instruments. Class 27. Machines and tools used in Morocco leather manufacture, marquetry, and toy making. Class 28. Goldsmith's work and clock making. Class 29. Weaving. Class 30. Manufacture of shoes and hats. Class 31. Making nets and other appliances for fishing. Class 32 includes agricultural implements, machines, and appliances for the preparation of food. Class 33 is restricted to mining and metallurgical plant, including steam engines, models of underground workings, appliances for the driving of tunnels, foundations by means of compressed air, furnace bars with water circulation, metals, alloys, and specimens. Class 34 embraces the plant of chemical works, paper mills, and dye works, new motors, utilization of the force of the tides, removing incrustation from steam boilers, etc.; and Class 35, the manufacture of arms and projectiles.

GROUP V.—*Mechanics Applied to Locomotion.*—In Class 37 will be represented railway plant, permanent way, and their maintenance, steep gradient lines; improvements in railway carriages, their lighting and heating; steam tram cars, locomotives working with compressed air, and traction engines; new brakes; underground lines and tunnels; and in Class 38 vehicles of different kinds employed by various nations, and velocipedes. Class 39 is devoted to navigation, and Class 40 to aeronautics; Class 41 to traveling appliances, including portable apparatus for scientific expeditions; and Class 42 to articles and products employed in the packing of goods, and lifting machinery.

GROUP VI.—*Applications of Natural Science* (Class 43) to *Agriculture and Horticulture*, and (Class 44) to *Forestry*.—Class 45 relates to the various natural products employed in industry; Class 46 to the utilization of textile fibers, basket work, straw paper, and cardboard; Class 47 to artificial flowers, fruits, and shrubs; Class 48 to natural history, with appliances for the taxidermist; Class 49 to useful and injurious insects, with methods for the destruction of the phylloxera. In Class 50 will be found specimens of alimentary substances. Class 51 relates to pisciculture; Class 52 to fisheries; Class 53 to non-alimentary sea produce; Class 54 to

medical science and instruments, and the acclimatization of cinchona and the eucalyptus in Africa and the South of France; Class 55 to surgical science and instruments; and Class 56 to dentistry. Class 57 covers the wide field of sanitary science, individual and general, comprising discoveries relating to hygiene and the well being of the working classes, baths, gymnasia; public and private closets, the purification and utilization of water, sluices, and sewers; appliances connected with highways and systems of paving; fire engines and fire signals; waterworks and mains; matters relating to hospitals and models; and, finally, appliances for cremation.

GROUP VII.—*Mathematical Instruments* for (Class 58) measuring, dividing, and calculation; (Class 59) astronomy and navigation, including balances, weights, and measures; (Class 60) astronomy; (Class 61) meteorology, and (Class 62) horology, including astronomical clocks and chronometers, public clocks and their illumination, pedometers, etc.

GROUP VIII.—*Geology* (Class 63) applied to agriculture and (Class 64) industry; artificial stone and raw products for ceramic art, with specimens. Class 65 includes mineral fuels and exploring plant, works for obtaining a water supply, artesian wells. Class 66. Precious stones. Class 67. Geological and palaeontological collections, plans, and sections.

GROUP IX.—In Class 68 will be found books, manuscripts, and designs relating to the classes of the Exhibition; while Class 69 will consist of replies to a series of questions, addressed to each exhibitor, either introduced or under consideration.

GROUP X.—*Special Exhibit of the Direction of the Exhibition of Sciences Applied to Chemistry.*—A. Reproduction of a glacier (about 10 meters high), with an internal grotto, wherein will be figured the different terrestrial formations, and the fossils met with in each of them. B. Reproduction on a large scale of a prehistoric habitation, a habitation of modern savages, and a model house of the present day, in which hygiene, comfort, and luxury have been attended to. C. A map in relief of Europe at the tertiary epoch. D. A grand dioramic view of the spot where Paris now stands, before the apparition of man on earth. E. Grand dioramic view of the same spot during the cave period.

GROUP XI. embraces a loan collection of artistic and industrial objects, and also temporary exhibitions of flowers, fruits, and vegetables.

The aim of the directors of this exhibition is to make it excel not in bulk, but in the careful selection and educational value of the objects and processes exhibited. The charge for exhibition space is low, and no charge will be made to workingmen, scientific societies, museums, governments, and exhibitors generally, whose productions are of an exceptionally interesting character.

RECENT AMERICAN PATENTS.

An improved mill for removing the germ and the fuzz from the kernels of wheat, without reducing the wheat or making flour, has been patented by Messrs. Samuel Potts and Orvid Parson, of Somerset, Wis. It is said that the flour made from wheat prepared by this mill is of superior quality.

An improved combined pocket match safe and candle holder has been patented by Mr. Francis A. Farrell, of Brooklyn, N. Y. It is compact and convenient, and may be readily carried in the pocket.

An improved discharge pipe plug for wash basins, patented by Mr. John S. Gilbert, of New York city, is so arranged that it cannot be removed from its wash basin, and will close automatically when released.

A new pad for securing an extra pad or housing to a harness saddle, which holds the pad securely, preventing it from sliding, drawing, and twisting, has been patented by Mr. Turner Buswell, of Solon, Me.

An improved cartridge, having a shell capable of taking a number of balls each, supplied with a separate charge of powder, and arranged so that the foremost charge will explode first and the others in succession, has been patented by Mr. John E. Tyler, of Roxobel, N. C.

Mr. Ira L. Sherman, of Cattaraugus, N. Y., has patented an improved iron fence, having an ornamental two-part rail which clamps the pickets on opposite sides, and is held together by sleeves which slip over the two parts.

Mr. George Lizars, of Paris, France, has devised an improved wet gas meter, provided with a compensating measuring drum, by which a uniform amount of gas is passed through the meter without regard to the level of the water.

An improved gag runner for harness has been patented by Mr. William M. Blain, of Salinas, Cal. It is adapted to receive a rosette loop for attachment to the bridle, and it forms a neat and simple attachment to the bridle for guiding the reins.

A novel and simple device for holding and displaying sample shoes on shoe boxes, has been patented by Mr. Benton Elliott, of Ellsworth, Wis. It consists of a spring clasp made from sheet metal, and it may be readily applied to the shoe and the box.

The Odor of Human Hair.

In *Le Progrès Médical* M. Galippe calls attention to the medico-legal value of the odor of the human hair. He asserts that from the simple smell of a lock of hair he can tell whether the lock has been cut from the living subject or whether it has been composed of hair that has fallen out. Hair dressers have acquired this art, which is said never to fail them. Hair which

has fallen out has a dull appearance, attributable to disease, and is not easily made up; it has no peculiar smell. The hair of the Chinese has a characteristic odor of musk, which is so persistent that it cannot be concealed by cosmetics, for it cannot be destroyed by washing with potash. The hair of the Chinese has also a reddish tinge, and is polyhedral in section. Hair of hysterical patients has a peculiar and distinguishing odor which is most perceptible at the approach of a crisis. Certain hair is electrical, the electricity being developed more readily after rubbing. M. Bert states that hair which is turned white from age begins to change color rather at the apex than at the base.

The Cultivation of Vanilla Beans.

It is probable that the plant which produces the vanilla bean will soon be grown to a larger extent than hitherto. At present the main supply of the bean comes from Mauritius, Brazil, and Mexico, but there is every reason to believe that the parasitical plant which produces the bean can be raised with profit in many other places having the necessary climatic conditions and trees which will afford it the requisite shade. The vanilla plant grows to the height of about a foot, thrives for 30 or 40 years, and produces about fifty pods each year after the second year. The beans require eight or nine months to mature. To prevent them from excessive shrinking they are oiled occasionally, and then are dried in the sun. When warm they are wrapped in woolen cloths to absorb the evaporation, and at this stage they acquire their fine silvery black color.

A Remedy for Whooping Cough.

Dr. Garth (*Wiener Allgem.*) states that by placing xx. gtt. ol. terebinth. on a handkerchief, holding it before the face, and taking about forty deep inspirations, to be repeated thrice daily, signal and marked relief, followed by rapid cure in cases of laryngeal catarrh, is the result. In an infant fifteen months old, in the convulsive stage of whooping cough, he directed the mother to hold a cloth, moistened as above, before it when awake, and to drop the oil upon its pillow when asleep. The result was markedly beneficial. In twenty-four hours the frequency and severity of the attacks were notably diminished, and by proper support by aid of stimulants, the improvement was rapid. Subsequently pertussis became epidemic in his vicinity, and he repeatedly used the drug in this way. He gave it to children of all ages, and in any stage of fever. The initial catarrh, the convulsive, and the final catarrhal stages were all decidedly benefited, the spasmodic attacks being in many cases aborted.

Heat Without Fuel.

Mr. M. A. Shepard, of Lebanon, Ill., has patented a method of utilizing the uniform temperature of the earth at a distance beneath the surface for the purpose of warming the air supplied to dwellings in winter and cooling it in summer. From a two column article in the *Lebanon Journal*, headed a "Wonderful Scientific Discovery," we take the following description of the leading features of his invention:

This new improvement is simply to sink a well or shaft into the earth till a living spring or stream of water is reached, which is invariably at the same temperature as the earth. At the bottom of this excavation is a series of coiled iron pipes (or they may be arranged similar to steam radiating pipes), placed down into the living water. At one end a connection is made to a large pipe extending to the surface of the earth, through which air is admitted to the series of pipes in the living water. At the other end a large pipe is connected, and arranged to communicate with the buildings to be supplied with air. All that now remains necessary to produce the uniform temperature of the water in the earth is to force or draw the air through these pipes and bring it into the buildings. This will require but a small amount of power.

The title of this new improvement and discovery is a new method of producing heat and ventilation. Patented March 11, 1879.

Strange Freak of Water Fowl.

For several mornings past the guards at the government bridge over the Mississippi River at this point, with other citizens whom they have informed of the occurrences, have been greatly interested in the actions of wild water fowl—ducks and geese, and even swans. About midnight these fowl commence gathering in the river, probably a mile above the bridge, and float down to the bridge, attracted, no doubt, by its lights. The moment they strike its shadow, as made by the lamps, they leave the water, fly up stream some distance, again float down to the bridge, and again rise and return, to repeat the trip. The bridge guards and tenders believe that these flocks often number 300 to 500 ducks and geese. Saturday morning four swans were seen with one flock. When they rise from the water they go up with a rush and whirr that can be heard three or four blocks distant. When the gray of dawn appears in the east the bridge men can see fowl leaving the water up stream as far as vision can reach—and off they fly for the north. The sloughs near to and the small streams which empty into the Mississippi were frozen during the recent cold snap, and the great river is the only open water the birds can find. But it is strange they do not alight in the water below the bridge as well as above it.—*Davenport (Iowa) Gazette*.

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 unequalled 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.

1857-1879.

OFFICE OF

R. J. Chard, Manufacturer of Oils, &c.,
134 MAIDEN LANE, NEW YORK.

Dear Sir:—The premises occupied by us for so many years having become too limited for our business, we have removed to No. 6 Burling Slip (within a block of the old stand), where we shall be pleased to meet our old customers. Thanking you for past favors, and trusting, with increased facilities, to merit a continuance of the same, we remain,

Your obedient servant,

R. J. CHARD.

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.

The best results are obtained by the Imp. Eureka Turbine Wheel and Barber's Pat. Pulverizing Mills. Send for descriptive pamphlets to Barber & Son, Allentown, Pa.

Valves and Hydrants, warranted to give perfect satisfaction. Chapman Valve Manuf. Co., Boston, Mass.

For Punches, Patent Bending-Rolls, Radial Drills, and Angle Iron Shears, Hilles & Jones, Wilmington, Del.

The Asbestos Roofing is the only reliable substitute for tin, it costs only one-half as much, is fully as durable, and can be easily applied by any one. H. W. Johns Mfg. Company are the sole manufacturers.

Catechism of the Locomotive, 635 pages, 250 engravings. The most accurate, complete, and easily understood book on the Locomotive. Price \$2.50. The Railroad Gazette, 73 Broadway, New York.

Magnets, Insulated Wire, etc., for experiments. Catalogue free. Goodnow & Wightman, 176 Washington St., Boston, Mass.

For Second-hand Engine Lathes, apply to Witherby, Rugg & Richardson, Worcester, Mass.

The Improved Hydraulic Jacks, Punches, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

A. H. Downer's Improved Boiler Liquid removes scale without injury, thereby saving fuel and increasing power. 17 Peck Slip, New York.

Acme Lathes.—Swing, 7 in.; turn, 19 in. long; back geared; screw cutting. Send 3 cent stamp for circular and price, to W. Donaldson, southwest corner Smith and Augusta, Cincinnati, Ohio.

Shaw's Mercury Gages, 5 to 50,000 lbs.; accurate, reliable, and durable. T. Shaw, 915 Ridge Ave., Phila., Pa.

The Twiss Automatic Engine; Also Vertical and Yacht Engines. N. W. Twiss, New Haven, Conn.

Wanted.—An energetic party with capital, to publish and introduce a small book (copyrighted), which will sell in every town in the country. Address, with reference, J. W. S., Lock Box 175, Phila., Pa., P. O.

New Pamphlet of "Burnham's Standard Turbine Wheel" sent free by N. E. Burnham, York, Pa.

17 and 20 in. Glibed Rest Screw Lathes. Geo. S. Lincoln & Co., Hartford, Conn.

Sheet Metal Presses, Ferracute Co., Bridgeton, N. J.

Diamond Engineer, J. Dickinson, 64 Nassau St., N.Y.

Eagle Anvils, 9 cents per pound. Fully warranted. Clipper Injector. J. D. Lynde, Philadelphia, Pa.

A Cupola works best with forced blast from a Baker Blower. Wilbraham Bros., 2318 Frankford Ave., Phila.

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

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

The Ornamental Penman's, Engraver's, Sign Writer's, and Stonecutter's Pocketbook of Alphabets; 32 plates; 20 cts; mail free. E. & F. N. Spon, 446 Broome St., N.Y.

Linen Hose.—Sizes: 1½ in., 20c.; 2 in., 25c.; 2½ in., 30c. per foot, subject to large discount. For price lists of all sizes, also rubber lined linen hose, address Eureka Fire Hose Company, No. 13 Barclay St., New York.

Dead Stroke Power Hammers; cheapest and best for general forging and die work; 500 in. up. P. S. Justice, of Philadelphia.

Forsyth & Co., Manchester, N. H., and 213 Centre St., New York. Specialties.—Bolt Forging Machines, Power Hammers, Combined Hand Fire Engines and Horse Carriages, new and 2d hand machinery. Send stamp for illustrated catalogues, stating just what you want.

Partner Wanted.—A party with limited capital.—Address Des Moines Lined Oil Works, Des Moines, Iowa. American Watch Tool Co., Waltham, Mass. Lathes for Optical Instrument Makers.

Presses, Dies, and Tools for working Sheet Metal, etc. Fruit & other can tools. Bliss & Williams, B'klyn, N. Y.

Nickel Plating.—A white deposit guaranteed by using our material. Condit, Hanson & Van Winkle, Newark, N.J.

Needle Pointed Iron, Brass, and Steel Wire for all purposes. W. Crabb, Newark, N. J.

The Lathes, Planers, Drills, and other Tools, new and second-hand, of the Wood & Light Machine Company, Worcester, are being sold out very low by the George Place Machinery Agency, 121 Chambers St., New York.

Twenty-five per cent saved by use of H. W. Johns' Asbestos Palm. 87 Maiden Lane, New York.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing Metals. E. Lyon & Co., 40 Grand St., N. Y.

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

Portland Cement—Roman & Keene's, for walks, cisterns, foundations, stables, cellars, bridges, reservoirs, breweries, etc. Remit 25 cents postage stamps for Practical Treatise on Cements. S. L. Merchant & Co., 53 Broadway, New York.

For Sale.—7 foot bed Putnam Planer, \$350. A. A. Pool & Co., Newark, N. J.

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.

C. M. Flint, Fitchburg, Mass., Mfr. of Saw Mills and Dogs, Shingle and Clapboard Machines. Circulars.

The best Friction Clutch Pulley and Friction Hoisting Machinery in the world, to be seen with power applied, 85 and 97 Liberty St., New York. D. Frisbie & Co., New Haven, Conn.

Wanted.—A Machine for Cutting a Hide into a Continuous Strip preparatory to running it through the tubes for sewing machine belts. Address Edmund Hill, 531 Jefferson St., Philadelphia, Pa.

The 1879 Pennsylvania Lawn Mower.—Light draught and easily adjusted. Machines warranted. See illustrated editorial, Sci. Am., No. 11. Lloyd, Supplee & Walton, Philadelphia, Pa.

Renshaw's Ratchet (short spindle) uses taper and square shank drills. Pratt & Whitney Co., Hartford, Ct.

Wheels and Pinions, heavy and light, remarkably strong and durable. Especially suited for sugar mills and similar work. Pittsburgh Steel Casting Company, Pittsburgh, Pa.

Wood-working Machinery, Weymouth Lathes. Specialty, Wardwell Patent Saw Bench; it has no equal. Improved Patent Planers; Elevators; Dowel Machines. Rollstone Machine Company, Fitchburg, Mass.

The new "Otto" Silent Gas Engine is simple in construction, easy of management, and the cheapest motor known for intermittent work. Schleicher, Schumm & Co., Philadelphia, Pa.

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.

Pulverizing Mills for all hard substances and grinding purposes. Walker Bros. & Co., 231 & Wood St., Phila., Pa.

The new fragrant Vanity Fair Cigarettes. New combinations of rare Old Perique and Virginia.

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

HINTS TO CORRESPONDENTS.

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

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

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

Correspondents whose inquiries do not appear after a reasonable time should repeat them.

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

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

(1) G. E. M. asks: Can you tell me how the fine lines of a micrometer, used in measuring microscopic objects, are ruled? A. By means of a very accurate and expensive machine called a dividing engine.

(2) P. J. W. asks: 1. What size battery will produce an electro-magnet of 50 lbs. lifting power? A. Use four or six cells of Bunsen. 2. Is there any means of estimating the attractive power of an electro-magnet at any given distance from its poles, the power at the pole being known? A. Magnetic attractions and repulsions are inversely as the squares of the distances.

(3) W. A. B. asks: 1. How can I procure the powered silver you mention in your issue of March 22, used in the light telephone? Will very fine silver filings do? A. We do not know that it is in the market; you can make it by grinding silver leaf with honey on a marble slab, afterward carefully removing the honey by repeated washings. 2. Are the wires connected the same in this telephone as in the carbon telephone? A. One wire is connected with the spring; the other to the metal plunger attached to the diaphragm.

(4) L. O. B. asks: 1. Does it make any difference which binding post of a Bell telephone is connected to the zinc pole of a battery? If it does how must it be connected? I want to experiment with a microphone. A. No. 2. Will one cell of a Watson battery be sufficient to operate a call bell, on a line 1 mile long? A. No; use four.

(5) G. R. D. asks: 1. What kind of paper is used to produce the stencil with the mechanical pen? A. Any thin paper, of smooth, firm texture. 2. How are copies taken after the stencil is made? A. By stretching the stencil in a frame, placing it in contact with the paper to receive the copy, and passing over it a roller charged with stencil ink.

(6) A. B. & B. ask: 1. How big a wire rope will it require, stretched over a span of forty feet, to sustain a load of one ton or 2,000 lbs.? A. 75 to 8 inch diameter. 2. How much will such a rope deflect in center, when stretched moderately tight, and what means are employed to get such a rope stretched tight enough? A. 3¼ feet. Consult Stahl's "Power by Wire Ropes."

(7) A. B. P. asks: 1. In making small magnets must I use fine or coarse wire? Tell why telegraph sounders are made with very fine wire, and magnets made to break the currents in shocking machines are coarse. A. The size of wire required for a magnet will depend altogether on the purpose for which the magnet is intended. The resistance of the wire is proportional to its size. If the magnet is used on a line of small resistance, the wire may be larger than when the resistance is great. Consult a good work on electricity. 2. How to make carbon for batteries. A. See SCIENTIFIC AMERICAN SUPPLEMENTS, Nos. 157, 158, and 159.

(8) P. J. asks: 1. In constructing an induction coil would hard wood or bone answer instead of vulcanite for the cylinder for commutator? Also for the tray in the "Simple Electric Light," described in SUPPLEMENT No. 162? A. Yes, in either case; but it should be filled with paraffine. 2. Will silver answer in place of platinum for point of screw and contact piece on the spring of the vibrating armature? If not, why? A. No; it will burn out too easily. 3. What is "tea paper," and where can I get it? A. The thin white paper used by grocers.

(9) S. W. writes: I am trying to plate steel knives and forks with tin. Please tell me what will cause the tin to flow smooth and appear white when finished. A. Clean the metal by scouring with moist pumice stone powder, and rinse in clean hot water, which will cause it to dry quickly. Then dip it in the melted tin covered with rosin, removing it frequently to rub with a brush of clean hemp. Then transfer for a short time to a pot of very hot tallow, free from salt, on removal from which tap smartly to remove list; cool, and clean with sawdust.

(10) D. B. B.—Please give a recipe for acid bath and process for resharpening old files in such a bath. A. The files must be thoroughly cleansed in warm water containing a small quantity of potash, which readily removes all the grease and dirt. After they are thus cleansed they must be washed with warm water and dried by artificial heat. Next place 1 pint of warm water in a wooden vessel and put in as many files as the water will cover, then add 2 oz. blue vitriol (sulphate of copper), finely pulverized, and 2 oz. borax, well mixed, taking care to turn the files over so that each may come in contact with the mixture. To the above mixture now add 7 oz. sulphuric acid and ¼ oz. cider vinegar, which will cause the files to assume a red appearance at first, but they will in a short time resume their natural color. Then remove them, wash in cold water, and dry by artificial heat. When dry, sponge with olive oil, wrap in porous paper, and lay aside for use.

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

C. M. M.—It is chiefly composed of iron pyrites (fool's gold)—of no value.—S. P.—The bead contains iron and copper—no silver.—H. B. It is an impure potter's clay. Properly washed it might be worth about a dollar per ton at the pottery.—E. F. A.—It is clay slate. It does not contain an appreciable quantity of gold or silver.—W. R. C.—It is a brown hematite (iron ore) of some value.

COMMUNICATIONS RECEIVED.

On Pigeon House. By H. R.
On Squaring the Circle. By R. R. P.
On Squaring the Circle. By C. M. G.
On Ice Caves. By A. L. R.
On Life and Electricity. By T. B. M.
On Grain Binding Material. By N. C. T.
On Sewer Gas. By D. W.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were
Granted in the Week Ending
April 1, 1879,

AND EACH BEARING THAT DATE.
[Those marked (r) are reissued patents.]

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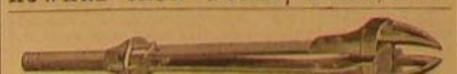
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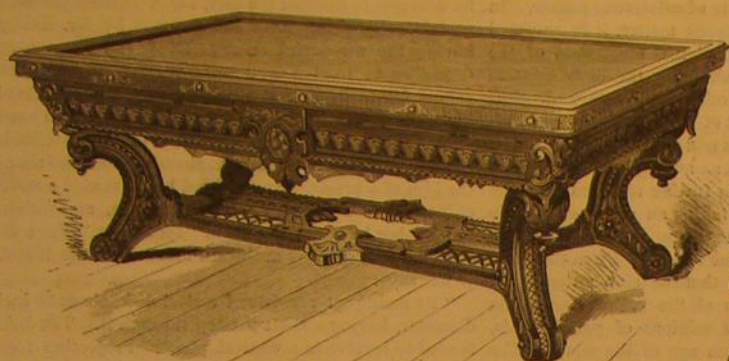
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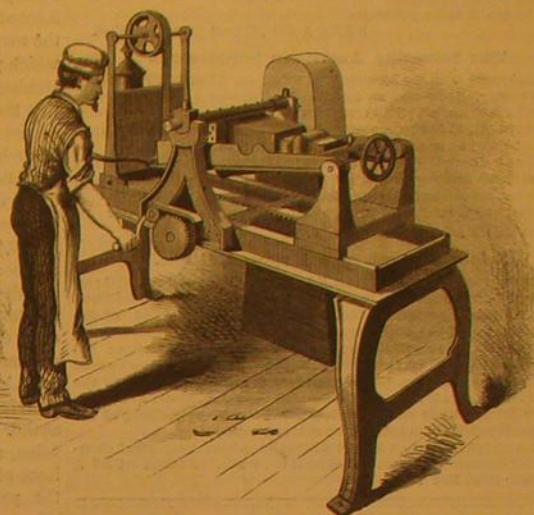
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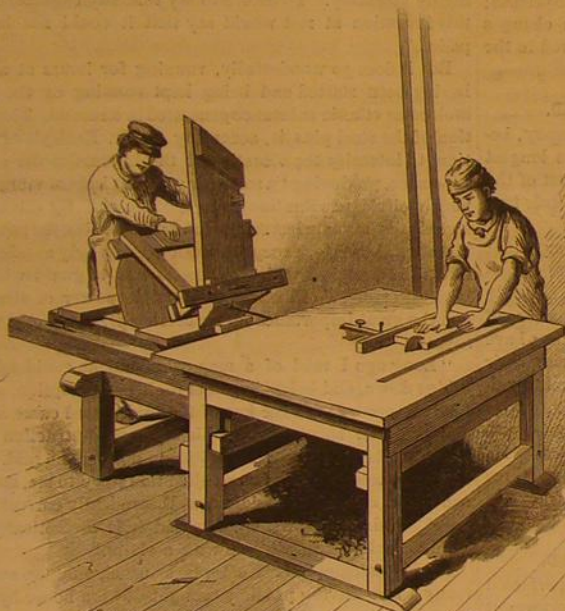
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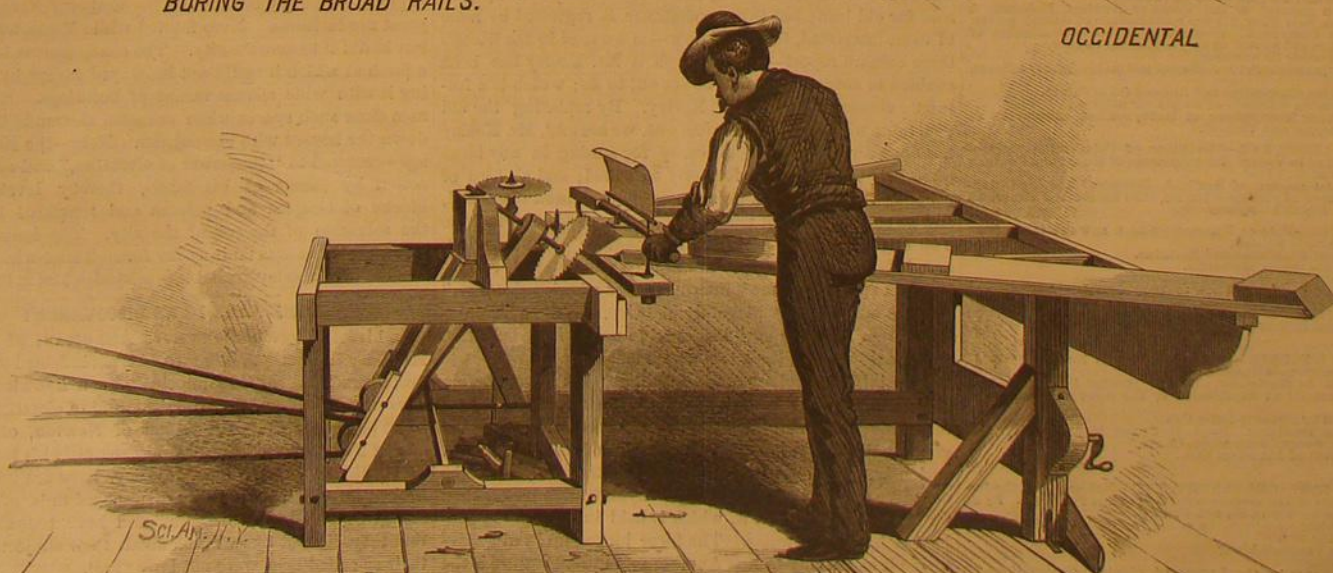
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 French Railway Appliances, 8 figures. Apparatus employed by the Paris, Lyons, and Mediterranean Railway for balancing carriage wheels, testing lubricants, heating foot warmers, etc.
 Use of compound Air Motors for Street Cars. Gen. H. Haupt's report to the Pneumatic Tramway Engine Company of New York.
 Skew-Bevel Wheels. No. III. By Professor C. W. MACCORD, 14 figures.
- II. TECHNOLOGY.—The Galvanizing Process. Interesting facts concerning zinc, iron and the process of galvanizing.
 "Excelsior." An account of the works of Huntley, Holcomb, & Hing, Silver Creek, New York, for the manufacture of milling goods.
 A New Blasting Compound. Description of the manufacture of Huetter's gun cotton and nitrate of baryta blasting powder.
 New Mode of Treating Caoutchouc.
 Glutine. A new preparation for stiffening and making glossy calicoes, wall paper, etc.
 A Varnish replacing Turpentine and Linseed Oil in Paints.
 Process for Preparing Sulphate of Baryta for painting.
 Improvement in the Manufacture of Methylamine. Apparatus of Messrs. Schutzenberger and Vincent.
- III. ELECTRICITY, LIGHT, ETC.—The Plane of Polarization Electro-Magnetically Rotated in Vapor. Investigations of Kundt and Routgen with Sulphide of Carbon vapor.
 Relative Chemical Energy of Sunlight, Electric Light, and Magnesium Light. Paper of Professor LEEDS, read before the American Chemical Society, March 5, 2 figures.
- IV. CHEMISTRY, ETC.—Note on Haemocyanine, a new substance from the blood of the *Octopus vulgaris*.
 A New Reaction of Kreatinine and Kreatine.
 Analysis of the Zee laaner Meteorite.
 Saffron. Methods of detecting adulterations.
 Crystals. Crystallography, and how to study crystals. A simple and practical method.
 Synthesis of Rhodanides and Ferro-cyanides. Note on the action of Chloral Hydrate and Rhodanide of Ammonium.
 New Dyes.
- V. MEDICINE AND HYGIENE.—Clinical Lecture on Burns. By R. J. LEVIE, M. D., Pennsylvania Hospital.
 Removal of Hair by Electricity. By GEO. HENRY FOX, M. D., New York.
 A novel method of depilation by the individual cautery of the follicles.
 Rash produced by Drugs in Daily Use.
 Carbolic Acid in Small-pox. By A. R. PLATT, Medical Officer, Imperial Maritime Customs, China-kiang, China.
 Gangrene. Benefit of hot water bath.
 Painless Death.
- VI. NATURAL HISTORY, GEOGRAPHY, ETC.—Volcanoes of the Pacific Coast. A study of the tertiary volcanoes of the Far West. By S. T. EMMONS, of the Survey of the 40th Parallel.
 Formation of Deltas.
 Mean Depth of the Sea.
 Alligators in the Yangtze-kiang.
 Intellect in Brutes.
 Absorption of Water by the Leaves of Plants. Observations of Boussingault and Henslow.
- VII. ARCHEOLOGY, ETC.—A Curious Stone Head, recently discovered at Dayton, Ohio.
 Interesting Antiquarian Researches. Late discoveries at the Lake of Neuchatel.
- VIII. ARCHITECTURE.—Oak Staircase and Screen. 1 illustration.
 New Grand Cemetery or Necropolis in Madrid, Spain. Premium design. Large illustration.

A NEW ESTIMATE OF THE WORLD'S AGE.

Geologists, astronomers, and physicists alike have hitherto been baffled in their attempts to set up any satisfactory kind of chronometers which will approximately measure geological time, and thus afford us some clew to the antiquity of our globe. Mr. Millard Reade, of Liverpool, has recently contributed to the Royal Society a very suggestive paper, in which he endeavors to grapple with the question by employing the limestone rocks of the earth's crust as an index of geological time. Limestones have been in course of formation from the earliest known geological periods, but it would appear that the later formed strata are more calcareous than the earlier, and that there has, in fact, been a gradually progressive increase of calcareous matter. The very extensive deposition of carbonate of lime over wide areas of the ocean bottom at the present day is sufficiently attested by the recent soundings of the Challenger. According to Mr. Reade's estimate, the sedimentary crust of the earth is at least one mile in average actual thickness, of which probably one tenth consists of calcareous matter. In seeking the origin of this calcareous matter, it is assumed that the primitive rocks of the original crust were of the nature of granitic or basaltic rocks. By the disintegration of such rocks, calcareous and other sedimentary deposits have been formed. The amount of lime salts in water which drain districts made of granites and basalts is found, by a comparison of analyses, to be on an average about 3.73 parts in 100,000 parts of water. It is further assumed that the exposed areas of igneous rocks, taking an average throughout all geological time, will bear to the exposures of sedimentary rocks a ratio of about one to nine. From these and other data Mr. Reade concludes that the elimination of the calcareous matter now found in all the sedimentary strata must have occupied at least 600 millions of years. This, therefore, represents the minimum age of the world. The author infers that the formation of the Laurentian, Cambrian, and Silurian strata must have occupied about 200 millions of years; the old red sandstone, the carboniferous, and the poikilitic systems, another 200 millions; and all the other strata, the remaining 200 millions. Mr. Reade is, therefore, led to believe that geological time has been enormously in excess of the limits urged by certain physicists; and that it has been ample to allow for all the changes which, on the hypothesis of evolution, have occurred in the organic world.

THE LONGEST TUNNEL IN THE WORLD.

The Joseph II. mining adit, at Schemnitz, Hungary, begun in 1782 and finished last October, is now the longest tunnel in the world. Its length is 16,538 meters; that of the St. Gothard tunnel being 14,920, and the Mount Cenis tunnel 12,233 meters.

The object of the adit is the drainage of the important gold and silver mines at Schemnitz. It furnishes a geological section more than ten miles in length, and gives not only valuable information as to the downward prolongation of the lodes known in the upper levels, but some new ones have been traversed, and the entire series of rocks, with their mutual limits as well as modifications and occasional transitions, are disclosed without interruption.

The entire cost of the tunnel was 4,599,000 florins—about \$2,300,000. Its height is 3 meters; width, 1.6 meter. By the methods of working employed during the last three years it would have taken twenty-seven years to do the entire work.

THE POWER OF VIBRATION HARNESSSED.

Mr. Keeley has made another advance, and has perfected what the *World* describes in small caps as "AN INVENTION WHICH SENSIBLE MEN BELIEVE MUST ERE LONG REVOLUTIONIZE THE GREAT INDUSTRIES OF MANKIND."

Mr. Keeley's former generator, which cost him \$60,000, was found to be inadequate, and has been broken up and sold for old iron; but this expenditure is regretted by none of those interested, for they know—so we read in the *World's* three column report—that through it Mr. Keeley has been enabled to accomplish what he set out to do; which is a fortunate circumstance for Mr. Keeley. By replacing the old generator with a new and perfect one, we are told, Mr. Keeley has done away with the necessity for storing in any large quantities the "vapor," formerly so called; and all idea of utilizing the power on a pressure engine has been discarded, and an engine has been made entirely new as to its principle. The engine is called a "vibratory engine;" and the whatever it is that runs the engine has been rechristened, receiving the expressive name "intermolecular etheric substance." This, as our readers will readily perceive, is quite a different thing from "cold vapor," and open to none of the scientific objections to which the latter was amenable.

This intermolecular etheric substance has never before been isolated either by chemical or mechanical means; and this achievement alone is sufficient to make Mr. Keeley the greatest discoverer of this age; indeed of all ages. And, curiously, the intermolecular etheric substance appears to be not more remarkable for its enormous expansive power than for the vast quantity of it, which is held in unresisting subjection by a little water. The force locked up in nitro-glycerine is as nothing to it. Another astounding feature is the ease with which intermolecular etheric substance is evolved and annihilated at will by Mr. Keeley. A pressure of 20,000 lb. to the square inch is generated simply by moving a lever about twelve inches long, so as to open and close a four-way valve placed within the "cross bar" of the generator, a

small quantity of water having been previously ejected into the generator by means of a small rubber bulb. Another notable circumstance is recorded by Mr. Keeley's reporter, namely, that when the intermolecular etheric substance is evolved and discharged, "neither heat nor cold is generated, and the elastic force is to the touch, when allowed to escape in substantial form, perfectly dry." One does not need to be a man of scientific education to appreciate a marvel like this. Even the common every-day experience of uneducated people will tell them how unusual it is for elastic force in substantial form, escaping under a pressure of 20,000 lb. to the square inch, to feel perfectly dry and neither hot nor cold. We can account for it only by supposing the intermolecular etheric substance, this solid elastic force, to possess a texture so fine that it passes through the hand intermolecularly without impinging on the gross matter through which the senses operate.

It would not be fair, the *World* writer observes considerably, to tell all he knows about Mr. Keeley's discovery; but he ventures to disclose the fact, for which we cannot be too grateful, that "the force so produced by Mr. Keeley, and having the wonderful energy stated, can be at once condensed so as to give a resulting vacuum." This discovery cannot fail to be of vast advantage to Professor Crookes in his researches upon the trajectory of molecules in *vacuo*.

To utilize the enormous energy of the intermolecular etheric substance Mr. Keeley, as already stated, has abandoned the idea of a pressure engine, and has invented a novel machine, which he calls a vibratory engine, and which after much labor he has succeeded in "focalizing." For a description of this engine we are again indebted to the *World*. The writer says:

"Its main part consists of a steel disk, about 30 inches in diameter, having a shaft passing through it. The disk is intended to revolve in a vertical plane. Projecting from the disk at right angles to it and near its periphery are a series of 288 steel pins about one eighth of an inch in diameter and varying in length from about five inches to two and one half inches, these pins being highly vibratory. This disk is surrounded with a cast iron casing resting on a cast iron bed-plate, underneath which are some steel disks that are also highly vibratory. I venture to say that any engineer seeing this invention at rest would say that it could not be propelled."

But it does go wonderfully, running for hours at a time, having been started and being kept running by the intermolecular etheric substance generated in a second. The function of the steel pins is, according to Mr. Keeley's explanation, to intensify the vibration of the intermolecular etheric substance, producing "a rotary or vertical circle of vibration," which circle of vibration runs the engine. By this device Mr. Keeley says he has succeeded in harnessing the power of vibration, hitherto, except in music, known only as a destructive power, against which engineers had to guard with the greatest care. To illustrate the terrible power of vibration and the great importance of harnessing it, the *World* writer says:

"Long ago I read of a man who said he could fiddle a bridge down, and being jeered at for his presumption, set his fiddle to accord with the key of the bridge, and came so dangerously near succeeding in his work of destruction as to convince the scoffers of his ability to do what he said. Mr. Keeley's motor and engine recalled this story to me, and also convinced me that the fiddler was theoretically correct in his boast. Indeed, Mr. Keeley says that it is theoretically possible to shake down a house with a violin."

In this statement Mr. Keeley is, as usual, only too modest, many a man having publicly brought down a house by skillful fiddling.

And just here we may express our conviction that Mr. Keeley's practical labors have furnished a demonstration of a theory which we have long entertained as furnishing an explanation of the conduct of the Emperor Nero during the great fire in Rome. Nero fiddled while Rome was burning, but he did it to save the city. The conflagration had reached a pitch at which it could not be stayed except by surrounding it with wide spaces vacant of buildings. Modern firemen clear such spaces when occasion demands by blowing down the houses with gunpowder. Nero—the Keeley of his age—resorted to "the power of vibration," and called it into action by means of his fiddle, thereby leveling whole blocks of temples and palaces and tenement houses, for the salvation of the rest of the city. The ignorant populace thought he was fiddling for fun. Those who do not understand Mr. Keeley are liable to misjudge him in like manner.

WHEN ARE LAWS DISCOVERED?

In his letter to the SCIENTIFIC AMERICAN, of April 5th, Mr. Gary intimates that the world is not indebted to "learned professors" and to "laboratories" for a knowledge of the laws of gravitation, of magnetism, and of electricity, and he takes pains to specify the names of Newton, of Franklin, and of Faraday, as if they would exemplify his text. He evidently thinks that ignorant plow boys have not unfrequently broken into these fields that are supposed to be in the special charge of "learned professors," and have taught the latter that they did not know much about their subjects, and that their so-called laws were not laws at all.

But Mr. Gary's knowledge of history is as defective as his knowledge of magnetism and of electricity, and it may interest him, and perhaps some others, to learn how much of the knowledge we possess on the above subjects came from "learned professors" and their "laboratories."

1st. "Newton with his apple." It is a mistake to imagine that the law of gravitation was discovered in the garden when the apple was observed to fall; that happened in 1666. The law was discovered in 1683, at the time when the calculations began to assume such shape that Newton became unable to finish them and handed them over to an assistant. The discovery unnerved Newton, but it was not in the garden, but seventeen years after the observation. If Newton really thought that his discovery was made in the garden, his emotion was certainly very late in showing itself.

2d. "Franklin with his kite." Now what Franklin discovered was not a law, but the identity of electricity and lightning, an interesting fact that had many applications, all in accordance with what was known about electricity. But Franklin was a skillful experimenter, and also knew well what others had done, and so far was quite unlike Mr. Gary, who brags that he is ignorant of what others have done.

3d. Precisely the same may be said concerning "Faraday and his magnets and iron filings." He had then been twenty years in the laboratory of the Royal Institution, and he was professor of chemistry then, and a very learned professor he was, too, in both electricity and magnetism.

4th. "The power of steam." Now the names of those who gave attention to that subject and developed the power are:

(1) Hero, of Alexandria, a mathematician and natural philosopher.

(2) Papin, a professor of mathematics in Marburg.

(3) Watt, an instrument maker to the University of Glasgow.

So far there is nothing to countenance the idea that conceited ignorance has added to the world's stock of knowledge in these directions; but let us see who has done the work and given us the laws in electricity and magnetism:

Gilbert, Fellow of the College of Physicians, London.

Galvani, Professor of Anatomy, University of Bologna.

Volta, Professor of Natural Philosophy, University of Pavia.

Oersted, Professor of Natural Philosophy, University of Copenhagen.

Ampère, Inspector General of the University of Paris.

Ohm, Professor of Mathematics, College of Cologne.

Weber, Professor of Natural Philosophy, Göttingen.

Faraday, Professor of Chemistry, Royal Institution, London.

Thomson, Professor of Natural Philosophy, University of Glasgow.

Maxwell, Professor of Natural Philosophy, University of Cambridge.

Henry, Professor of Natural Philosophy, Princeton College.

These are the men who have discovered about all we know about these matters; so it is evident that "learned professors" have done the work, and it was done in "laboratories." When Mr. Gary took his supposed discovery to the late Professor Henry, the latter, after listening patiently to his statement, told him to buy \$50 worth of books and study up on magnetism before he wasted more time in experiment, and to this advice may now be made the recommendation that before he writes any more history of science he be at the pains of studying it more carefully. E.

MOLECULAR CHEMISTRY.—No. 1.

The question whether matter is or is not infinitely divisible is of no direct consequence to theoretical chemistry, as we are not in possession of any facts that could enable us to decide it. We do, however, possess evidence that matter exists in the form of exceedingly minute particles. The porosity of bodies, their compressibility, and their contraction and expansion when they are cooled or heated, would alone warrant the conclusion that the matter they contain exists in a state of division, because it does not fill the space it occupies. The familiar experiment of mixing half a pint of absolute alcohol with half a pint of water and obtaining less than one pint of mixture admits of no other interpretation than that these substances consist of particles separated by spaces, and that some of the particles of one have found their way into the interstices of the other.

Let us now see how this purely physical conception of matter will aid us in the explanation of chemical facts.

On analyzing the chloride, the bromide, and the iodide of hydrogen, we find them to contain for every gramme of hydrogen: 35.368 grammes of chlorine, 79.750 of bromine, and 126.533 of iodine. Again, these identical quantities are found in combination with 39.040 grammes of potassium in each case, and also with 22.980 grammes of sodium in each case. It appears, then, that 39.040 grammes of potassium are proportional or equivalent to 22.980 grammes of sodium and to 1 gramme of hydrogen; also, that 35.368 grammes of chlorine are equivalent to 79.750 of bromine and to 126.533 of iodine. The analysis of vast numbers of chemical compounds has shown these figures to be invariable, and it has been ascertained not only that the substances mentioned, but that every element has a weight peculiar to itself, which it retains throughout all its numerous compounds. In other words, the constituents of a chemical compound are combined in fixed unalterable proportions. Thus, pure chloride of sodium, no matter how it may be prepared or from what part of the world it may be obtained, always contains its chlorine and its sodium in the proportion of 35.368 to 22.980. Hence chemical formulae are made to tell us not only what elements a substance contains, but also in what proportions they are combined. Chemists have their table of combining numbers, and when they write down the initial letters of elements, as for instance HCl, they mean one part by weight of hydrogen combined with 126.533 parts of iodine.

To Wenzel and Richter belongs the credit of having first recognized the equivalent relations between the quantities of different bases required to neutralize the same acid, and also between the quantities of different acids necessary to neutralize the same base.

Dalton discovered that carbonic acid contains the same quantity of carbon as carbonic oxide, but twice as much oxygen; also that marsh gas contains as much carbon as olefiant gas, but twice as much hydrogen. From these and many other facts he formulated the following law, which has been firmly established by extensive investigations. When a substance combines with a greater weight of another than the ascertained equivalent or proportional weight of the latter, it will do so with twice, three times, four times, etc., that equivalent, and not with any intermediate or fractional number. Thus 14.009 parts by weight of nitrogen will combine with 15.960, or 2×15.960 , or 3×15.960 , or 4×15.960 , or 5×15.960 parts of oxygen, but not with $1\frac{1}{2}$, $1\frac{1}{4}$, $1\frac{1}{3}$, etc., times 15.960.

The explanation of this wonderful fundamental fact of chemical science is as profound as it is simple. We have seen that matter is composed of particles separated by spaces; we now learn that these particles have different weights. The weight of a particle of hydrogen being taken as unity, the weight of a particle of oxygen will be 15.960, of nitrogen 14.009, of chlorine 35.368, of sodium 22.980. These ultimate particles have received the name of atoms, and we retain this name, not because they cannot be further subdivided—an assertion that would lead us to pure speculation—but because they constitute the smallest undivided portions of matter whose actual existence we have a right to affirm. Without complicating the present discussion with the details of the dynamical or kinetic theory, it will be stated, and no doubt readily conceded, that these atoms must be regarded as the centers or vehicles of forces, and as subject to the laws that govern larger bodies of matter. Now, what happens when two substances combine? The atoms of one simply enter in the sphere of attraction of the atoms of the other, and arrange themselves in groups or nuclei, each of which acts as a whole, and the result is a compound body having new properties. Now, it is evident that we may have a nucleus composed of one atom of nitrogen + one atom of oxygen (NO), or of one atom of nitrogen + two of oxygen (NO_2), etc.; but as these atoms are never divided, we cannot have $1\text{ N} + 1\frac{1}{2}\text{ O}$. We may therefore reasonably conclude that the atoms of different substances possess different weights, and that the combining or equivalent numbers, determined with the utmost care from innumerable analyses, especially by Berzelius and Stas, represent the relative weights of these atoms. What their absolute weight may be we cannot tell; all we know is that an atom of oxygen weighs 15.960 times as much as an atom of hydrogen, and so for the other elements. It follows, furthermore, that the combining weights of a compound body must be equal to the sum of the atomic weight of its constituents, which clearly explains the discovery of Wenzel and Richter alluded to above.

Let us now examine the method by which the combining, or, as we may now call them, the atomic weights of the elements have been ascertained. Suppose we had analyzed 100 grammes of water and found them to contain 11.11 grammes of hydrogen and 88.89 grammes of oxygen. The proportion is evidently very nearly as 1:8; but the question arises, How many atoms of oxygen and how many of hydrogen are necessary to form the smallest possible quantity of water? If water contains one atom of each, the combining weight of oxygen is 8; if it contains two of hydrogen to one of oxygen (H_2O) the combining weight of oxygen is 16; if it contain two of oxygen to one of hydrogen (HO_2) the combining weight of oxygen is 4, etc. Our analysis does not tell us. If we analyzed all possible combinations of oxygen, and so ascertained that it never combines in a quantity less than 16 (more accurately 15.960); or if, in a similar way, we found that water never combines in a lower proportion than 17.960, we might then safely set down the composition of water as H_2O , or $2 \times 1 + 1 \times 15.960 = 17.960$, two atoms of hydrogen for every atom of oxygen. Such a course would, however, involve an amount of labor and an accumulation of difficulties that would render it impossible in practice. It will be the subject of the next paper to show how these difficulties were overcome, and how the way was paved for further discovery. C. F. K.

EDISON'S ELECTRIC ILLUMINATOR AND DR. DRAPER'S EXPERIMENTS THIRTY YEARS AGO.

Now that the publication of Mr. Edison's patents for electric illumination has made the public acquainted with the details of his process, it is well to recall what had been done on this subject many years ago.

Dr. John W. Draper, in a memoir published in the *American Journal of Arts and Sciences*, 1847, and also in the *London, Edinburgh, and Dublin Philosophical Magazine* of the same year, gave an exhaustive examination of this subject. He used a strip of platinum, brought to incandescence by the passage of a voltaic current through it, and showed that the light emitted increases in brilliancy far more rapidly than the increments of temperature. The strip of platinum, brought to a proper temperature by the passage of the electric current, was connected with an index lever, which measured its expansion. The results thus obtained proved that the increase in the intensity of the light of the ignited platinum became very rapid as the temperature rose. At 2,590° Fah. the brilliancy of the light was more than thirty-six times as great as it was at 1,900°. This paper is reprinted

as Memoir I. in his recently published "Scientific Memoirs" (Harper & Bros.).

The facts he had thus obtained he applied practically in the construction of a lamp. At p. 45, in the volume referred to, he says:

"Among writers on optics it has been a desideratum to obtain an artificial light of standard brilliancy. The preceding experiments furnish an easy means of supplying that want, and give us what might be termed a 'unit lamp.' A surface of platinum of standard dimensions, raised to a standard temperature by a voltaic current, will always emit a constant light. A strip of that metal, one inch long and one twentieth of an inch wide, connected with a lever by which its expansion might be measured, would yield at 2,000° Fah. a light suitable for most purposes. An ingenious artist would have very little difficulty, by taking advantage of the movements of the lever, in making a self-acting apparatus, in which the platinum should be maintained at a uniform temperature, notwithstanding any change taking place in the voltaic current."

This memoir treats of the whole subject of the incandescence of platinum very exhaustively, measuring the heat emitted, the light emitted, and its spectrum analysis. Gas companies and others, interested in the rivalry between electric and gas illumination, will do well to examine it closely. Though printed in 1867 the experiments it relates were made two or three years previously. Subsequently Dr. Draper used iridio-platinum, and found that he could obtain a much brighter light because of its greater infusibility. At that time the method could not be recommended for public use, because it required a nitric acid battery. The dynamo-electric machine has of late years removed that difficulty.

AMERICAN INDUSTRIES.—No. 12.

THE MANUFACTURE OF BILLIARD TABLES.

To business men and men of sedentary habits the question of exercise and recreation is a vital one. Of course there are endless varieties of amusement that may be indulged in, some being beneficial and desirable, while others are pernicious and to be deprecated. Among forms of innocent diversion, a game of billiards may be commended as being a mild form of exercise which sufficiently occupies the mind to dispel thoughts of business, while it brings into action almost every muscle in the body.

Billiards, like every other game or amusement, may be perverted; but the legitimate use of the ball and cue is undoubtedly beneficial. The game is a social one, and may be properly played by both sexes. That it is growing in popularity is shown by the constantly increasing demand for billiard tables and their appurtenances.

There are now several manufactories of billiard tables in the United States, but perhaps the oldest and the largest is that of Mr. H. W. Collender. These works are situated in the beautiful village of Stamford, Conn. The five story building, with its two towers and French roof, appears more like a modern university building than a manufactory.

The basement contains the engine driven by steam from a boiler in the adjoining boiler house. It also contains the machinery for cutting and planing lumber, and for sawing the slate which forms the bed of the table. The offices and packing room occupy the first floor. Upon the second floor the broad rails and cushions are made. Upon the third floor there is a variety of machinery invented by Mr. Collender especially for the manufacture of these tables. Upon the fourth floor the various parts that have been made by machinery and by hand are assembled and fitted; and upon the fifth floor the varnishing and polishing are done.

In making the wooden frame of the table only the choicest materials can be used, and the wood requires three years' seasoning to insure its staying in place. The corners of the broad rails are carefully mitred and bored by accurate machinery, shown in the lower portion of the engraving, on the first page, and they are fitted to iron corner pieces having a socket for receiving the leg. All of the cross-pieces are secured by iron sockets, so that when the parts of the table are fastened together they are not liable to be thrown out of adjustment by atmospheric changes.

The legs are shaped by the machine shown in the upper right hand corner of the engraving, and are sand-papered by the machine shown in the central figure. The varnishing and polishing are of necessity done by hand. A large number of men are constantly employed in this department, giving the final touches which render the exterior of the table attractive. After having spent more than twenty years in perfecting the wooden frame of the billiard table so that it would always support the slate bed in a true plane, Mr. Collender has devised two forms of iron frame of elegant design, which support the bed at every point and are entirely exempt from any objection that might be brought against wooden frames. These tables, the "Imperial" and the "Occidental," are shown in our engraving.

In many points the manufacture of billiard tables is like that of a piano or first class article of furniture, but greater accuracy is required than in either of the branches referred to. As an evidence of the superiority of these tables we may mention that at the Centennial and the Paris Exhibitions they took the highest premium. The warerooms of Mr. H. W. Collender are at 788 Broadway, New York; 84 and 86 State street, Chicago, Ill.; and 17 South Fifth street, St. Louis, Mo.

A JAPANESE EXHIBITION.—The second General Industrial Exhibition in Tokio is announced for 1881. The latest census gives Tokio a population of 1,043,000.

TESTING LUBRICANTS.

We give, from *Engineering*, engravings of a machine employed by the Eastern Railway Company of France for ascertaining the value of various lubricants, the particular machine illustrated being one which was exhibited by the company, at Paris, last year. Referring to Fig. 1, it will be seen that the testing apparatus consists of a horizontal iron disk, A, driven at a uniform speed, and having bearing upon its upper surface three gun metal blocks, *ttt*, fitted to a second disk, B; this second disk being pressed down on that first mentioned by means of a lever, R, fitted with an adjustable weight. A small hand worked lifting arrangement, D, enables the weighted lever, R, to be raised so that the upper disk, B, can be removed, and the lubricating material to be tested spread over the surface of the disk, A.

When the arrangement just described is in operation it is evident that the disk, A, as it revolves, will tend to drag the disk, B, round with it, the rotative force thus exerted depending upon the pressure exercised upon the disk, B, and upon the nature of the lubricating material between the two rubbing surfaces. By connecting the spring of a dynamometer to the periphery of the disk, B, the amount of work absorbed in friction during the time that a sample of lubricant is being used up can be ascertained, while, the duration of the experiment being duly noted and the elevation of temperature registered, the data are obtained for forming a practical estimate of the value of the lubricant under trial. The dynamometrical apparatus consists of a weight, X, slung by a band passing over a cam fixed on a horizontal spindle mounted on the frame, F, the periphery of the disk, B, being also connected to the cam just mentioned, so that as the disk, B, is dragged round by disk, A, the weight, X, is raised. Owing to the form of the cam, the weight, X, offers a constantly increasing resistance as it is lifted, and the amount by which the weight is raised is thus a measure of the force with which the disk, B, is dragged round; or, in other words, it is a measure of the friction between the disk, A, and the rubbing pieces, *ttt*. The amount by which the weight, X, is raised is registered as follows: The spindle on which the cam is fixed carries also a small pinion, S, which engages with a rack actuating the style, K, and thus gives to the latter a movement proportional to the force with which the disk, B, is dragged round. The style, K, shown to a larger scale in Fig. 3, is fitted with a spindle, *a*, provided with a fork carrying the small cutting roller, *b*, and this roller, being pressed down on to a continuous band of paper, H, by the counterweights, L, marks on the paper a curve, which forms a measure of the frictional grip between the disks, A and B.

The uniform movement of the paper, H, is obtained by means of a worm mounted on the driving shaft, U, of the machine, this worm gearing into a worm wheel, V, fixed on a spindle carrying a cylinder which forces the band of paper against a second divided cylinder. This latter cylinder receives a rotative movement by gear so proportioned that the strip of paper is advanced one millimeter at each turn of the disk, A, while an inking apparatus, G, also driven by gearing, enables the millimeter divisions to be printed on the band of paper as it

passes. The time of an experiment is recorded by an electric clock, I, which makes a mark upon the band of paper every half minute.

The uniform rotation of the disk, A, is secured by the use of a centrifugal governor acting through the ingenious

mean position of the governor, the latter establishes a contact between the plate, *r*, and the one at the other of the contact points, *q q'*, and by so doing causes a current to traverse the coils of the one or the other of the electro-magnets, *gg*. The arrangement of the connections will be readily understood from Fig. 2, from which it will be seen that the positive pole of a single cell Bunsen battery is connected to a shaft, *f*, on which the two electro-magnets are mounted, one end of the coils of each magnet being also connected to this shaft. The other, or negative, pole of the battery is connected to the spring, *r*, and according as the governor rises or falls it is thus brought into connection with the contact points, *q* and *q'*, respectively. These points are, in their turn, connected by wires, one to each electro-magnet, the contact point, *q'*, being connected to the left hand and *q* to the right hand electro-magnet in Fig. 2. Thus, if the governor rises, a current is made to traverse the coils of the right hand electro-magnet; or *vice versa*, if the governor falls, the left hand magnet is brought into operation. The shaft, *f*, on which are mounted two electro-magnets, also carries two loose pulleys, *d d'*, which are driven by belts from the pulleys, *d d*, on the main driving shaft of the apparatus, one of the belts being crossed and the other open, so that the loose pulleys, *d' d'*, are driven in opposite directions. On the central part of the shaft, *f*, a screw is cut, and a nut, *e*, fitted to this screw carries a fork acting on the belt connecting the

two pulleys, *c c*. The upper of these conical pulleys is fixed on a shaft, which carries also a pulley from which a belt is led off to the fast and loose pulleys, M. This speed governor is very sensitive, and is found to control the speed well.

Toward the end of the experiment, as the lubricant becomes used up, the friction between the two disks, A, B, increases, and as soon as it reaches an amount greater than the

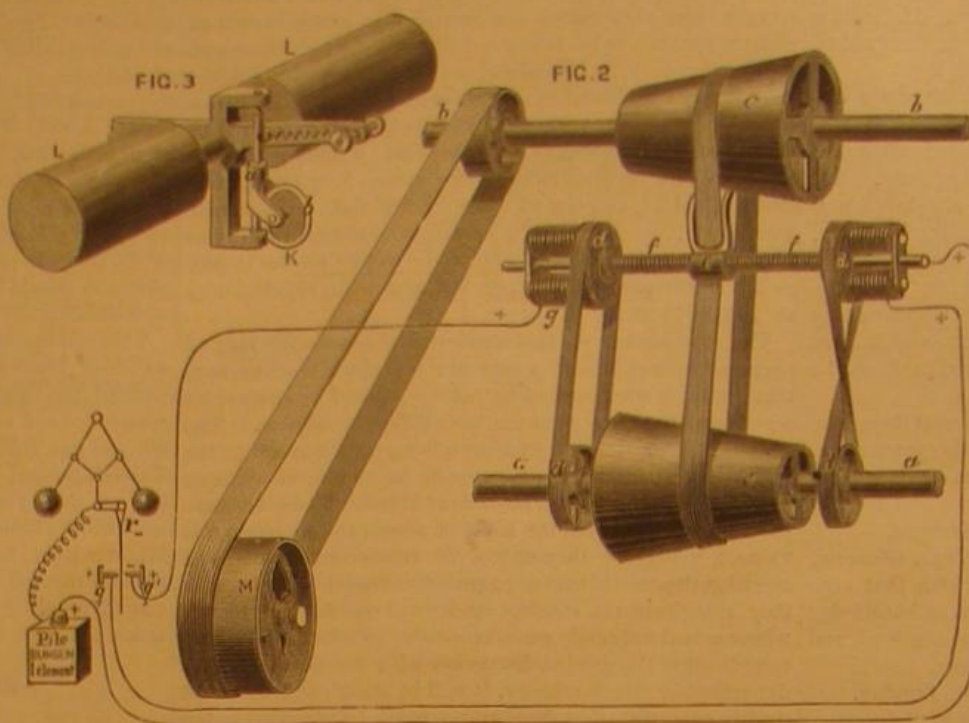
resistance offered by the weight, X, the disk, B, is carried round, and a stop on it comes into contact with the abutment, R, the detent, Q, being at the same time operated upon and the weighted lever, P, liberated, this lever, as it falls, moving the driving belt from the fast to the loose pulley, and so stopping the apparatus.

The curve drawn on the traveling paper indicates, by its greater or less regularity, the general behavior of the lubricant during the experiment, while it also affords a measure of the coefficient of friction. The diagram also indicates the duration of the experiment.

The residue left on the surface of the disk, A, assists, by its appearance, the deductions regarding the value of the lubricant.

Ether with Cod Liver OIL.

The fact that cod liver oil cannot be tolerated in a very large number of cases where the use of the remedy is indicated, led the New York Therapeutical Society to refer to a committee, for investigation, the claims of Dr. Foster, who first suggested the combination of the oil with ether as a means of overcoming the difficulty. The committee, after an examination of 94 cases, report that the evidence before them warrants the conclusions: (1) That the addition of ether to cod liver oil, in about the proportion of fifteen minims to each half ounce (or an equivalent amount of Hoffman's anodyne instead of ether), will succeed in the vast



Figs. 2 and 3.—TESTING LUBRICANTS.

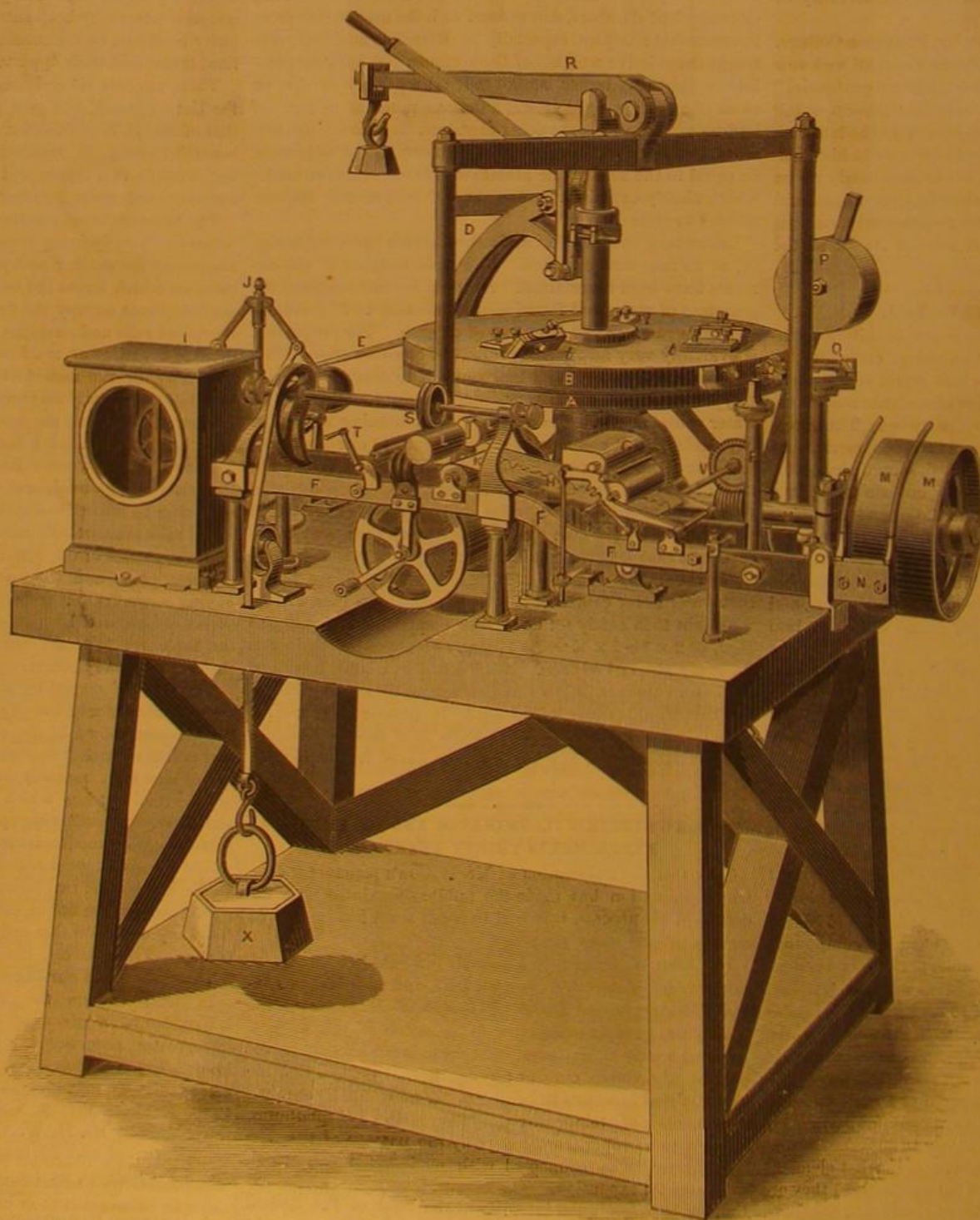


Fig. 1.—MACHINE FOR TESTING LUBRICANTS.

majority of cases in enabling the patient to take the oil, even though it previously disagreed; (2) that in some cases in which the oil still disagrees after the addition of the ether, the difficulty may be overcome by giving the ether separately from fifteen minutes to half an hour after the oil is taken. No facts were laid before the committee from which they could judge as to whether the etherized oil is superior to the plain oil in its ultimate effect upon nutrition; supposing them to be equally well tolerated by the stomach.

A FEW NOVELTIES.

The accompanying engraving represents several simple inventions recently patented in the United States. Most of them are of the class that sell for a few cents—a class of inventions that are, as a rule, more profitable than any other.

Fig. 1 shows an improved candlestick invented by Mr. John Frick, of New York city. It is composed of three parts, two of which cross each other and form the base and support for the candle; the third, the disk, is slotted radially to receive the crosspieces, and has a turned-up edge for retaining any tallow that may drip from the candle.

A can opener is shown in Fig. 2; the knife used in it in Fig. 3. This instrument consists of a frame which receives the top of the can, having attached to it a handle and carrying the small knife, which cuts the cover as the opener is

with two or more rows of inwardly projecting teeth, and having a handle by which it is manipulated. The sheller is held by one hand, and the ear of corn is thrust into it and turned with the other hand.

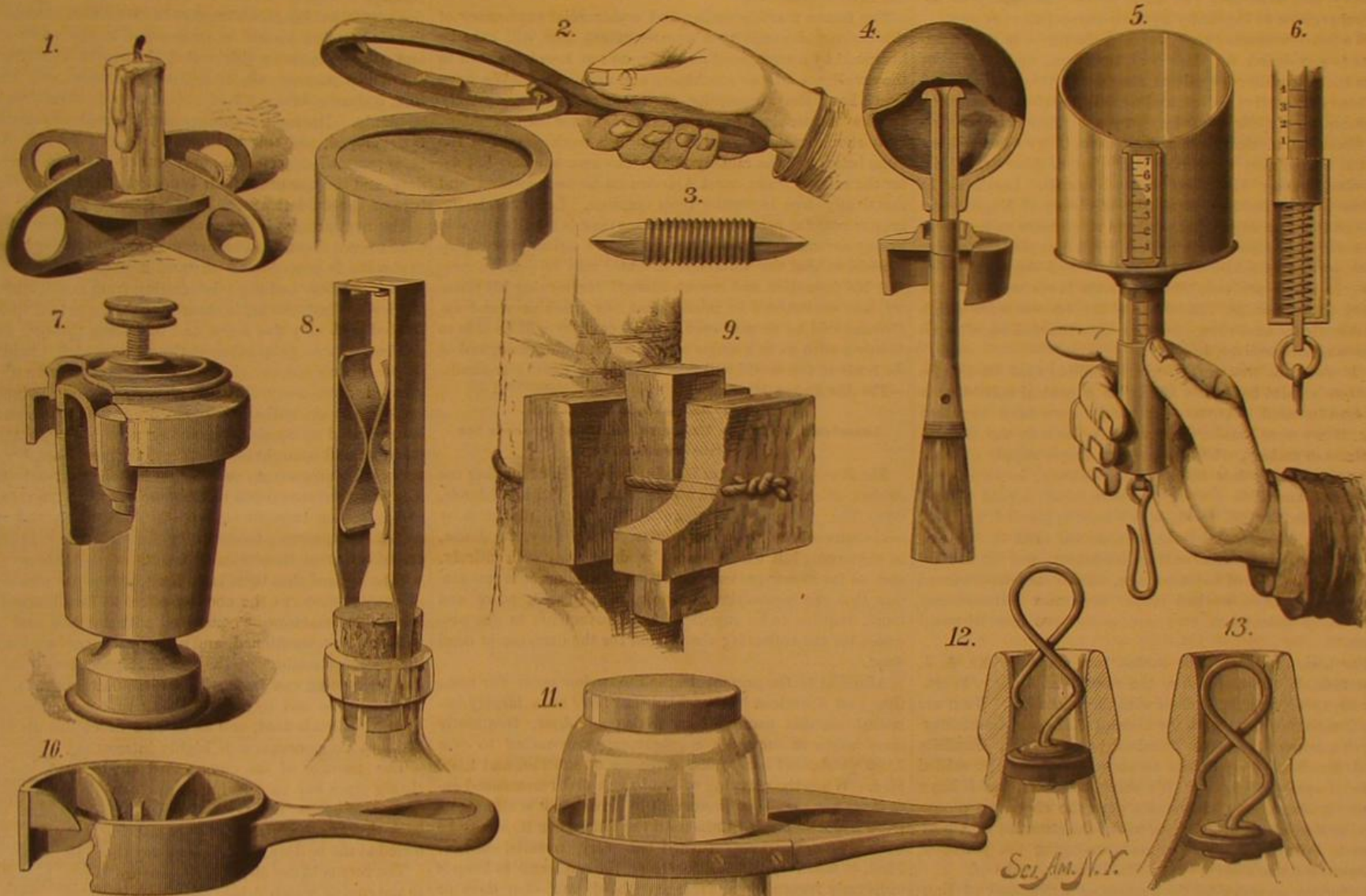
A simple and effective wrench for holding fruit jars while the cover is applied or removed, is shown in Fig. 11. It is the invention of Messrs. D. Sherman and G. D. Dudley, of Lowell, Mass., and it consists of two handles connected by a band which passes around the jar. The inventors prefer to use wood in its manufacture and to make it entirely of one piece.

The bottle stopper shown in Figs. 12 and 13 is the invention of Mr. C. G. Hutchinson, of Chicago, Ill. It consists of a wire loop of peculiar form, having attached to it a rubber disk which acts as the stopper. Fig. 12 shows the bottle stopped; Fig. 13 shows it open.

The Discipline of Education.

A great deal that is said about the importance of classical education as a discipline of the mind largely disregards the operation of ordinary duties in this direction. We can imagine that a young nobleman, so situated as to be above or beyond those compulsory circumstances that force the average man to exertion, would without the discipline of a college education fall into very loose and idle mental habits.

with the competitions of life that it is scarcely traceable. We have always found that men whose necessities force them to bend their energies to work are the men who hold themselves well in hand, and that other men usually have little power of application; that is, the classification does not distinguish between educated and uneducated men, but between working and non-working men. In the list of men who have attained success or contributed notably to the world's advance, it will not be found that those who have exhibited remarkable mental power and intellectual self-command are specially on the side of the university class. Three of the most conspicuous men in English philosophy and science—Herbert Spencer, Huxley, and Tyndall—have developed their remarkable powers from the impulses of their natural gifts and not by the aid of college discipline or classical guiding. Perhaps their labors would have been easier under a thorough preparatory course—this is not easy to gainsay—but the fact remains that in the pursuit of their several ends they have brought their mental forces under complete and perfect control. Necessity is the great master, and it operates on all classes of society—it gives the power of concentration to the lawyer, teaches the physician to be self-contained and studious, gives efficiency to the pen of the writer, drills the bookkeeper and the clerk, and trains the hand of the artisan. It is an ever-present and most exacting



RECENTLY PATENTED NOVELTIES.

turned on the top of the can. Mr. T. F. Wilson, of Washington, D. C., is the inventor of this device.

A fountain mucilage brush, the invention of Mr. J. B. Davids, of New York city, is shown in Fig. 4. It consists of a brush adapted to a bottle, and provided with a tubular handle, having on its upper end an elastic bulb for containing mucilage or any other liquid to be applied with the brush. By compressing the elastic bulb and dipping the brush in the liquid and then allowing it to expand, the liquid is drawn into the bulb through the hollow brush handle, a small hole being provided near the lower end of the handle to admit the liquid.

The improved weighing scoop shown in Figs. 5 and 6 was recently patented by Mr. John Berks, of Ogdensburg, N. Y. It has a spring balance in the handle, and is graduated so that it may be used for measuring as well as weighing.

An improved nozzle for holding dies in the process of hardening is shown in Fig. 7. It is the invention of Mr. Joseph B. Harmstead, of San Francisco, Cal. It is especially designed for use in mints. The face of the die is hardened first, the back being protected by the inwardly projecting rim.

Mr. L. C. Mumford, of San Francisco, Cal., has devised a cork extractor, shown in Fig. 8. It is made wholly of spring sheet metal. Its construction, as well as the manner of using, will be readily understood by reference to the engraving.

Mr. Ezra A. Quinby, of Memory, Iowa, the inventor of the tree compress shown in Fig. 9, claims that by applying the compress so as to prevent the return of the sap to the roots the limbs will mature much earlier than they otherwise would, and will bear fruit earlier and in greater quantities.

Fig. 10 shows a hand corn sheller invented by Mr. George W. Grimes, of Bluffton, Ind. It consists in a ring, provided

College training is with him the only thing that will teach him to govern his desires, to concentrate his attention, and to bring his mind under the control of his will. Without the obligations and stimulus of college life he would be likely to develop into a very slothful and self-indulgent maturity, with little command over his faculties and little inclination to exercise them. It is this fact, we apprehend, that lies at the root of nearly all the utterances that we hear upon the subject—utterances that are for the most part traditional, that are borrowed from the higher ranks of English life, and which are derived from observations purely special and local in their character. They apply with equal force to a small proportion of our own people, it being evident that young men of wealth would sink into marked inferiority if educational discipline did not extend well into their manhood. But we are convinced that the requirements of the schools, the mental training which comes of a study of the ancient languages and the higher mathematics, are far from being so completely disciplinary as the ordinary experiences of the professions and the trades. The lawyer in his practice soon gains the power of concentration, and is fairly compelled to bring his mind under the control of his will, his discipline being more thorough, more exacting, more sustained, than any that can be invented by college systems. The daily experience of the physician is likewise efficient in bringing all the functions of the mind into subordination and under control. It is only by sustained effort and severe concentration that the man of letters can succeed; the painter and the poet are helpless if their intellectual powers are not fully at their command. It will be said here that the exact purpose of college discipline is to prepare men for these exacting duties. But in our observation training at college bears so small a proportion to that which comes

schoolmaster; and, as with an immense majority of people this schoolmaster begins his lessons in youth by means of the struggles and burdens of life, and continues them without relaxation to the end, the discipline within certain limits is complete—the self-control being general, but the proficiency lying, in each case, solely along the line of experience. —*Appleton's Journal*.

The Formation of Character.

There is a practical as well as a scientific basis for the position taken by the Rev. Phillips Brooks in a recent discourse in this city, namely, that the law of evolution rules in the moral as well as in the physical world. Nature does not create, but is always developing. In last summer's roots nature finds the germ for next summer's verdure.

"If somebody should give me a diamond to carry to Europe, I can know exactly how much would be lost to the world were I to drop it into the sea; but if a seed should be given me, I can only regard it with awe as containing concealed within it the food of untold generations. That is the difference between looking at truth as a diamond or as a seed—as final or germinal.

"In all training of character, continuity and economy must be supreme. The notion that character is spontaneous is held by most people in the earlier portion of their lives, and is wrong. When they discover this, nine tenths change to the other extreme. This is wrong too. Hosts of young men think that their character will form of itself and that they will necessarily become better as they grow older. Hosts of old men believe that their character is fixed and that it is impossible for them to become better. Such beliefs are foolish. People are also wrong in thinking that they can put off their bad traits and put on good traits. The old failures cannot

be thus transformed, but out of the old habits new can be formed. This is what many a poor creature needs to know. We must make what we are to be out of what we are already."

Machinery in America.

In our leading remarks last month we endeavored to show the important part which machinery may be made to perform in enabling us to oust all competitors from our own markets, and in enabling us to make a profit and still undersell in countries where protective duties have been increased on the importation of English manufactured goods.

Our remarks have met with some attention from some of our most deservedly distinguished men, and the question at issue has chiefly turned on the patent laws. Are cheap patents good for the trade of the country? Lord Selborne says "No." We say "Yes."

The United States of America already possesses cheap patent laws, the cost of obtaining a complete patent there only amounting to £13 and upward, against £190 in this country at the present time, and it is therefore a fair argument to consider what advantages these laws give to the manufacturers in the States. Taking this standpoint, we assert at once that their power to compete where they now do with English makers is traceable to the perfection of their machinery, and that they owe their perfect machinery to the stimulus given to ingenuity by their cheap patent system.

We must remember that the manufacturers in the States have to pay dearer for their coal, their iron, and their labor than their English competitors; they are further handicapped by heavy protective duties; and we ask, therefore, what is the explanation of their advantage over us? How is it possible for them to undersell us in any one item if we have such essential advantages to start with? Let us hear what Mr. Thomas Brassey, M.P., has to say about it. Lecturing in January, 1878, on the comparative efficiency of English and foreign labor, he urged that we have much more to fear from the highly paid labor of America, which brought labor-saving machinery and mechanical skill to such a high degree of perfection [the italics are ours] than from the lower wages of the Continent of Europe. Referring to the success with which the Americans have competed with us in the making of small arms and locomotives, he says:

"It would at first sight seem incredible that our engine builders should have been beaten in a neutral market with no hostile tariff. Anyhow, it would have been expected that, if we were beaten, it would have been by the Belgian or German makers, who command an ample supply of labor at comparatively low rates. The contrary, however, has happened, and it is a country where labor is paid at rates unknown in the Old World which has supplanted us. We have been conquered by the mechanical skill of the employer in devising labor-saving machinery, and by the industry and energy of the workmen, who, if they have earned high wages, have worked longer and more industriously than many among our own mechanics have been disposed to do."

The above remarks were quoted in a paper by Mr. A. J. Mundella, M.P., read before the Statistical Society, February 19, 1878. The paper dealt with the question, "What are the Conditions on which the Commercial and Manufacturing Supremacy of Great Britain depends?" Mr. Mundella used Mr. Brassey's remarks to show that American skilled labor is equal to English. We think, however, that it has a great significance in connection with the cheap patent system, as that alone accounts to us for the stimulus to Americans to be always inventing and producing the perfected labor-saving machinery which Mr. Brassey speaks of.

In further considering the comparative efficiency of English and American labor, Mr. Mundella himself incidentally touches on the importance of the machinery. He says:

"The American under equal conditions will produce nearly, though not quite, as much as the Englishman. Wherever I have found him producing more it was due to his having been furnished with better machinery and appliances to work with."

In the discussion on Mr. Mundella's paper, Mr. J. B. Brown, who stated that he had given a great deal of attention to the question of the comparative efficiency of American and English labor, said:

"Everywhere he went in America he found the manufacturers were in favor of protective duties. A large number of the most intelligent of them said they would willingly yield a great portion of the tariff at once, because the American workmen and the improved American machinery could hold themselves against the world. . . . From his own experience, he found that the American machinery on the whole was superior to the English, quite as well made, generally more ingenious, and more successful in saving manual labor."

Another speaker (Mr. H. D. Pochin), said:

"There was a time when our workmen were equal to any workmen in the world; but any one acquainted with the facts would know that in certain classes of machinery we were outdone by the Americans, not because they had greater skill than our own workmen, but because of the spirit that was abroad among them, and the doctrines that were being instilled into them."

The foregoing testimony to the efficiency of American machinery is all the more valuable for our purpose because of its incidental character. We find our point further supported in an article which appeared in the *Fortnightly Review* for March, entitled "An American View of American Com-

petition." In it, the writer, after referring to the small army required by the United States of America, and the room for immigration, says:

"If there is any force in this reasoning, our competition with other manufacturing countries in supplying neutral markets with manufactured goods will not be compassed by low rates of wages paid to our factory operatives, or to the working people engaged in our metal works and other occupations, but first, by obtaining and keeping such an advanced position in the application and use of improved tools and machinery as shall make high wages consistent with a low cost of production."

We think the evidence we have quoted clearly establishes this one fact that, although paying higher wages, and paying more for materials, the manufacturers of the States are able to compete in neutral markets with certain classes of goods, simply and entirely owing to having better, *i. e.*, more productive or more economical labor-saving machinery than we have in this country.

Now we come back to inquire how it is that the Americans have better devised machinery than we have. The answer we have to this serious question is contained in a simple remark made to us once by an intelligent workman, who had been in the United States: "You see, in America you can get a patent for £10 or so, and every one thinks how he can invent something."

The future manufacturing and commercial supremacy of this country depends to a greater extent than will ever be imagined by a superficial observer, on our keeping ahead in the excellence of our machinery and appliances. We have seen how the superiority of the American machinery enables the masters to pay high wages for skilled labor. Why should not England and English workmen have the same benefit? The remedy lies in our own hands. Let us, for the sake of trade, meet America on its own ground, and practically free ingenuity from taxation. Let there be no greater cost for protecting inventions than is readily payable by any saving workman. Let the people agitate for cheap patents, so that the humblest inventor may be able to protect his invention and recoup himself for serving his country, and we venture to predict that our machinery and appliances will be so perfected that no country will be able to compete with us in a single article worth mentioning, and so the trade of the world will flow unreservedly into our hands. —*The Machinery Market.*

American Meats in England.—A New Process for Preservation.

The Farm, published in Dublin, Ireland, in discussing the subject of importing live cattle into the British Islands, says: The carrying of live cattle over great distances by sea is surrounded with difficulties, which may, no doubt, be overcome, but which cannot be done away with entirely, and, so far as our present experience has gone, it seems certain that the necessities of these islands will, more and more, require to be supplied by improvements in the processes for the collecting abroad and for the carrying of dead meat.

Alluding to the present traffic the writer says: For some time past American beef and mutton have been largely imported into this country. In Liverpool alone, frequently there arrive in one week consignments amounting to over 5,000 quarters of beef, 1,500 carcasses of mutton, and 1,000 pigs. When the carrying of dead meat first commenced endeavors were made to preserve it by freezing it while quite fresh and keeping it frozen until the time when it was to be used. This, however, turned out very unsatisfactorily. First, it was very difficult to freeze the meat and to keep it uniformly frozen for a great length of time—ten days or more; and in the next place, it was very soon found that meat which has been frozen undergoes decomposition with extraordinary rapidity as soon as it is thawed. No doubt, the cellular texture is broken up by the freezing process in such a way as to favor decomposition if once commenced.

A great improvement on the "freezing process" was introduced two or three years ago. The animals are slaughtered under the best conditions as to health and cleanliness. The carcasses, having been quickly cleaned, cut up, and covered with a loose pack sheet, are hung in a chamber which is kept cooled with dry air, at a temperature not so low as that of freezing, but at about 35° Fah., which is three degrees above the freezing point. Until now this has been effected by supplying the meat chambers with air that has been passed backward and forward through tubes which are cooled in a chamber packed with ice. A steam engine forces or draws air through these tubes, and throws it into the meat chambers. In passing through the tubes the air is thoroughly cooled, and the moisture which it possesses is at the same time removed, condensing in the tubes and being allowed to run away. When it enters the slightly warmer meat chambers it is both sufficiently cold to keep down their temperature, and sufficiently deprived of moisture to be comparatively dry.

The carrying of meat by this process has been most successful. Not a cargo has been lost, we believe. It is necessary to carry a spare supply of ice to provide against accidental delays. The extra ice can, however, be sold at a fair price, though ice machines in this country have made foreign ice much less valuable.

Very recently a machine has been constructed in Glasgow, at the Finnieston Engineering Works, and has been tested with the most satisfactory results. A large chamber in which dead meat was suspended was kept at a temperature

of about 35° for several weeks at a time in the autumn of 1878. At the end of the time the meat proved to be perfectly sound and good; and it remained so after being taken out of the cooling chamber and kept for several days. Subsequently an experiment was commenced in which the chamber was maintained for a long period, about three months, at a temperature close to the freezing point, with the hope of being able to import dead meat from Australia and New Zealand. These experiments are still being carried on, with results which, up to the present time, are quite satisfactory. It is the invention of a Mr. Coleman.

The principles of the machine may be briefly explained. When air is compressed it becomes heated. This is very commonly shown, as an experiment, by means of an air syringe, in which the ordinary exit is closed with a stop cock. When the piston is suddenly forced into the barrel by a blow, the air contained within the barrel becomes compressed, and is heated to so high a temperature that a bit of German tinder placed within the barrel can easily be set on fire. Conversely, if a quantity of highly compressed air is allowed to expand, doing work against pressure in expanding, it becomes cooled. Mr. Coleman's machine depends for its action on these principles. Its object is to obtain a large quantity of highly compressed dry air at a low temperature; to allow the air to expand, not merely rushing off through a stop cock, but to expand doing work such as is done by steam in a steam engine—under which circumstances the air becomes cooled in proportion to the work it does; and, finally, to throw this cooled air into the meat chambers.

For this purpose, air, at ordinary pressure and temperature, is drawn into a set of cylinders, and then compressed suddenly. During the compression a great amount of heat is developed, and this has now to be got rid of. Accordingly, water is injected in spray into the compressing cylinders, and the compressed air is cooled down to the temperature of the coldest water.

The next process is to remove the water, and at the same time to cool down the compressed air still further before the expansion is proceeded with; and a part of this process is most ingenious, and most interesting from a scientific point of view. First, the air is thrown against a set of disks perforated with very fine holes, and in passing through this fine grating, a large proportion of the water which is held up by the air in very minute globules is then taken from it, and is allowed to run away through cleverly devised valves; but, further, the air, still at high pressure it will be remembered, is conducted up by slanting zigzag pipes through the meat chamber and brought back. Now, the meat chamber is at a very cold temperature, and the air in being carried through it is being reduced down to the temperature of the chamber, and it is then brought back to the engine to be still further cooled in expanding from its compressed state. In this lies one of the great theoretical interests of the process; for it will be noticed that there is no limit, except the practical one of construction, to the cooling effect to be obtained. Let one cooling machine be connected with another, and a third with the first mentioned, and so on, each one working from the cooled chamber of the one that precedes it in order, and the cooling can be carried on indefinitely. We should, of course, be met by difficulties as to conduction of heat by the materials used, and as to loss of chilled air by leakage, but the conception is highly interesting.

The passage of the compressed air through the chilled zigzag pipes has another important use. Any moisture still contained by the compressed air is condensed, and trickles back through the tubes which are slanting upwards. It is collected at the bottom, and passes away through proper valves.

The very cold dry air, at high pressure, is now brought back to the engine which drives the whole machine. This engine is an ingenious compound engine. It is worked partly by steam and partly by the highly compressed air. The steam piston and the air piston are both connected to the movable parts of the engine, and each does a portion of the whole work. The cylinders for steam and air are, of course, quite distinct. The part of the engine driven by steam we need not refer to; it is with the expansion of the air that we are concerned here. It is allowed to enter the cylinder at high pressure; doing so, it forces the piston before it, expanding and doing work. When, by expanding, it has come down to atmospheric pressure, it is intensely cold, and it is then allowed to escape from the cylinder through proper valves during the back stroke of the engine. It is passed forward by tubes, which are covered with felt, or some non-conducting material, to prevent loss of cold, and allowed to enter the meat chamber.

There are a great many beautiful and ingenious details in the construction of the machine to which it is impossible to refer in this notice. Among the practical difficulties that arose in the working of it was the lubrication of the air part of the engine. All the oils tried became frozen and clogged the moving parts. The lubrication is now effected with glycerine, which does not freeze.

Discussing the causes of the depression in English trade, the *Pall Mall Gazette* remarks that the substitution of steel for iron by the Bessemer process, and still more by the elimination of phosphorus from the Cleveland ores (now positively accomplished) is a revolution as great as followed upon the inventions of Crompton and Arkwright. It means, most probably, the total decay of the iron trade of North and South Wales, of Scotland, and of a large part of Staffordshire. In the end it will largely benefit England, but the transition is full of suffering.

NEW AGRICULTURAL INVENTIONS.

Mr. George L. Gifford, of San Antonio, Texas, has invented an improvement in gang plows, in which a number of plows are connected with a single beam, and placed so that parallel furrows are thrown up. The plows may be adjusted to any desired angle.

An improved grain drill, for drilling wheat and other grain, has been patented by Mr. Perry E. Browning, of Brownsville, Ky. It may be used upon inclined or uneven ground, distributing the seed uniformly under all circumstances.

Mr. Albert H. Mason, of Niles, O., has devised an improved hay elevator, which may be suspended from the top of the barn, and is so arranged that it will lift the hay from the wagon and deposit it in the mow for distribution.

A wagon body, which may be readily converted into a rack, has been patented by Mr. Levi Talcott, of Minetto, N. Y. The matter of arranging the parts so as to form either a wagon body or wagon rack is very simple.

An improved device for removing and collecting bugs from vines has been patented by Messrs. George W. Wood and Charles H. Smith, of Faribault, Minn. It consists in an apparatus mounted on wheels, and having wings for gathering the tops of the plants and shaking the bugs into a receptacle from which they cannot escape.

THE DETROIT RIVER TUNNEL AND BRIDGE.

The beginning of the railway tunnel under the Detroit River, below Detroit, was formally celebrated April 23. It was originally intended to prosecute the work by the cofferdam process, but the plan was disapproved by the Canada authorities because of the threatened obstruction to navigation. It is now proposed to construct the tunnel by boring, though the results of the initial operations were not encouraging. The rock, a soft limestone, was found to be so broken by fissures and so full of water as to raise a doubt as to the possibility of completing the work by boring. A fair trial will be made, however, and the hope is that the plan first proposed will be consented to in case of failure by boring. When completed the tunnel will greatly facilitate the business of the Canada and Southern Railroad, and will control the southwest traffic.

The bridge project is designed to connect the Great Western and Grand Trunk Railways of Canada with the Northern Michigan and Michigan Central Railways at Detroit by crossing the river a short distance above Windsor, where Belle Isle divides the stream into two channels.

The bridge will extend from Hamtramck, on the Michigan shore, to Belle Isle, and will have a draw of 300 feet; and from the island it will extend to Walkerville, on the Canadian shore, a distance of 2,500 feet. In the latter distance there will be three drawbridges, of 300 feet each, leaving, excepting a pier in the center, 600 feet for navigation. It is claimed by the promoters of the bridge that two sets of boats can pass at one time within each of the 300 feet draws. The bridge will be 14 feet above water level. The draws can be swung within four minutes. The bridge will command a view two miles distant on either side, and the current will not be remarkably rapid. It is said that the bridge will be an open one.

THE PATENTEES' PROTECTIVE ASSOCIATION.

During the congressional contest over the proposed alteration of the patent laws last winter, the SCIENTIFIC AMERICAN received from inventors throughout the country not a few communications suggesting and urging a union of inventors and patentees for the better protection and advancement of their rights and interests. The opinion of the paper was freely expressed that a quicker and surer method of protecting patent interests would be through immediate individual action, by which the sentiment of the people could be brought to bear on their representatives in Congress. Fortunately the threatened subversion of the patent system was defeated in the House, mainly, we believe, in consequence of just such personal efforts for the enlightenment of Congress as we had urged.

The desire for union among patentees, however, seems not to have been fruitless. At a meeting in Louisville, Ky., in February, an organization of patentees was begun, and the following preamble was adopted:

"Whereas, The unparalleled progress which, in a single century, has raised the American people from a dependent colony to the foremost rank among nations, is largely due to the genius of her inventors, stimulated by liberal patent laws;

"Therefore, We do hereby organize under the title of the 'Patentees' Protective Association,' to protect the interests of inventors, and all others interested, under the patent laws of the United States, and to guard the public against imposition, that no discredit may rest upon our national patent system."

The Hon. Eugene Undwood was elected president; and the secretary, Mr. H. Burkhardt, writes us that the design is to form, eventually, a national association of inventors and patentees. The office of the association is at No. 30 Third St., Louisville, Ky.

THE School of Art Needlework, which was opened in Boston last October, has been remarkably successful. It has had one hundred and eighty-four paying pupils and forty-five free pupils, and their work, for originality and artistic feeling, is said to be wonderful.

Patent Office Report for 1878.

Summary of the business transactions of the United States Patent Office for the calendar year ending December 31, 1878, as shown by the annual report of the Commissioner of Patents to Congress:

APPLICATIONS RECEIVED, PATENTS ALLOWED, ETC.

Applications for patents, including designs	20,260
Applications for releases of patents	638
Patents issued, including designs	12,935
Patents renewed	509
Caveats filed	2,755
Patents expired during the year, exclusive of designs	2,617
Patents withheld for non-payment of final fee	833
Applications for registration of trade marks	1,577
Trade marks registered	1,455
Applications for registration of labels	700
Labels registered	492

Number of patents issued to the several States and Territories, with the ratio of population to each patent granted; also the number of patents issued to subjects or citizens of foreign governments:

STATES AND TERRITORIES.	Patents and Designs.	One to every
Alabama	39	25,563
Arizona Territory	2	4,829
Arkansas	45	10,776
California	320	1,750
Colorado	35	1,138
Connecticut	529	1,015
Dakota Territory	5	2,836
Delaware	39	3,209
District of Columbia	146	908
Florida	3	65,582
Georgia	105	1,127
Idaho Territory	2	7,499
Illinois	908	2,547
Indiana	345	4,842
Iowa	325	3,676
Kansas	63	5,784
Kentucky	145	9,110
Louisiana	76	9,564
Maine	140	4,477
Maryland	183	4,267
Massachusetts	1,199	1,218
Michigan	390	3,036
Minnesota	129	3,408
Mississippi	38	21,787
Missouri	315	5,499
Montana Territory	3	3,805
Nebraska	50	2,459
Nevada	36	1,180
New Hampshire	92	3,459
New Jersey	490	3,870
New Mexico Territory	3	30,634
New York	2,599	1,085
North Carolina	53	20,214
Ohio	1,070	2,490
Oregon	35	2,568
Pennsylvania	1,296	2,718
Rhode Island	190	1,143
South Carolina	28	25,300
Tennessee	98	12,842
Texas	130	6,219
Utah Territory	7	12,398
Vermont	109	3,032
Virginia	113	10,842
Washington Territory	13	1,842
West Virginia	58	7,620
Wisconsin	251	4,218
Wyoming Territory	4	1,138
United States Army	8	
United States Navy	1	
Total	12,354	

Of the patents, including designs, there were granted to the—

Citizens of the United States	12,354
Subjects of Great Britain, including Canada	336
of France	60
of Germany	98
of other foreign governments	87
Total	12,935

Germany's Subterranean Telegraph System.

The system of subterranean telegraph wires designed by the Postmaster General of the German Empire will be completed, according to present arrangements, in a year and a half. Two lines will then traverse the empire diagonally; the one running from northeast to southwest, from Königsberg to Strasbourg, the other from northwest to southeast, from Hamburg to Ratibor, a town in the extreme south of Silesia. These two main lines will cross one another in Berlin. In the west of the empire a subterranean telegraph will run in a curve from Strasbourg through Cologne to Hamburg; in the east another line will connect Königsberg with Ratibor; and finally, a cable will traverse southern Germany, running generally east and west, though apparently the exact route for this last telegraph has not yet been definitely decided upon. When the proposed system is completed, therefore, all the fortresses and commercial towns of any importance in Germany will be connected with one another by subterranean wires. The cable first laid down, that from Berlin to Halle, has been subjected to the severest scientific tests, and the results have been most satisfactory. A great advantage of the subterranean system is that it avoids all interruptions by storms.

The Teleelectroscope.

We have recently on one or two occasions alluded to the teleelectroscope invented by M. Senlecq, of Ardres. We now have before us some very ingenious and curious applications of selenium, in which its peculiar property of changing its electrical conductivity when exposed to light varying in intensity is utilized. The several devices are the invention of Mr. George R. Carey, of Boston, Mass. Perhaps the most curious of these instruments is the selenium camera obscura, which is capable of transmitting telegraphically an image of any object and making a permanent impression of it at a distant point. In this case a person may sit before the camera in New York while his photograph is made in Boston. Mr. Carey employs two methods of accomplishing the object, one being something like M. Senlecq's, and the other totally different. We hope to present to our readers before long the details of these interesting instruments.

DISINFECTION.

The State Board of Health of Massachusetts have lately given to the public the following useful information on the above subject:

Recent experiments made under the direction of the International Cholera Commission have shown that the ordinary methods of disinfection are inefficient, and in practice they have often failed to arrest the spread of infectious diseases.

As it is impossible to experiment directly upon the unknown low organisms, which are thought to be the means of transporting the various infectious diseases, the effects of chlorine and sulphurous acid were studied upon known living organisms; the probabilities being thought to be in favor of the theory that complete disinfection should destroy at least all known forms of life, although it may be true that the tenacity of life of the infective matter of various diseases differs, just as the degree of cold necessary to put a stop to yellow fever is much less than that required to arrest the spread of cholera.

Chlorine and sulphur fumes, in sufficient quantity, were found to be efficient in killing insects, fungi, bacteria, and infusoria: the objections to chlorine in houses being that it is more costly, that its use is more difficult, and that it destroys metals, textile fabrics, and colors.

The burning of ten grammes of sulphur for each cubic meter of air space, tightly closed, was found not to kill bacteria, infusoria, or all insects; twenty grammes, however, were proved to be sufficient for that purpose. One volume of water, when saturated at 59° Fah., absorbs thirty-seven volumes of sulphurous acid—enough to kill all the low organisms found in putrid urine.

The following articles were found uninjured after several hours' exposure to an atmosphere in which twenty grammes of sulphur had been burned to every cubic meter of air space: A clock of steel and brass, rusty and clean nails, gold and silver money, a military epaulet, various colored silk articles, a colored rug, calico, down pillows, a gilt framed looking-glass, books, water in an uncorked bottle, flour, meat, salt, bread, apples, cinnamon, vanilla, cigars, wall paper, oil paintings, varnished articles, gas fixtures, water fixtures; a highly polished razor had a slightly cloudy appearance on its upper side, but that was easily rubbed off. The flour and meat were cooked and eaten, and the cigars were smoked, without any abnormal taste or smell being observed; in the bread not all of the observers noticed a slightly acid taste; the inside portion of the apples was unchanged, the skin was slightly sour; the water, after standing, had an acid reaction, but no decided taste or smell. Litmus paper placed between the leaves of books and under the carpet was turned bright red. Many of the articles exposed had a decided smell of sulphur at first, but that soon disappeared.

The experiments seemed to show that clothing, bedding, and other articles may be disinfected without being changed chemically or injured; and it should be added that practically this method has apparently accomplished perfect disinfection, as tested in Berlin.

If we may judge from these results, effective disinfection, by burning sulphur, requires eighteen ounces to each space of one thousand cubic feet. The sulphur should be broken in small pieces, burned over a vessel of water or sand, so as to avoid danger from fire, and, if the room is large, it should be put in separate vessels in different places. The room should be tightly closed for six hours and then aired; it is better that the room should be warm than cold. Of course, efficiently disinfected air is, during the process of disinfection, irrespirable. Most articles may be disinfected in this way, if hung up loosely in the fumigated chamber, although it would be an additional safeguard to expose anything thick, like a bed mattress, to prolonged heat at a temperature of about 240° Fah., and, indeed, heat must, with our present knowledge, be considered the best disinfectant. With this end in view, local boards of health are advised to procure furnaces and laundries, as is commonly done in other countries, to be used for the sole purpose of disinfecting articles which have been exposed to the infectious diseases, as recommended in the Ninth Annual Report of the State Board of Health, and described by Dr. A. H. Johnson, in an exhaustive paper on scarlet fever (pp. 255 et seq.), in that report. Of course, a much simpler disinfecting furnace than that described will answer every purpose. For ordinary use, in disinfecting houses, the sulphur process is the best.

A solution of chloride of zinc (one part of Burnett's disinfecting fluid to two hundred of water) very quickly kills bacteria which have been placed in it, and arrests putrefaction. Caustic lime serves equally as well (1 to 100), but leaves a sediment not always easy to remove. Carbolic acid in sufficient strength to be effective (1 to 100) is more expensive and of disagreeable odor.

It is needless to add that "disinfectants" used in sufficient quantities to destroy bad smells do not necessarily kill microscopic living organisms; and it is not supposed that they directly influence the so-called "germs" of the infectious diseases, unless concentrated to the extent which has been mentioned.

Finally, fresh, pure air acts as one of the best "disinfectants" by enormously diluting the infectious matter, and, under certain conditions, including time, must render it inert to all effect, even if not quickly destroying it, as many think is the case.

A COMPLIMENT to the Hancock Inspirator has just been awarded to it by the English Government ordering a number of the machines.

IMPROVED PAPER CUTTING AND WINDING MACHINE.

Our engraving illustrates an improved machine for cutting roll paper, such as is used in telegraphy, for rolling ribbons for hat bindings, etc.

The machine, although quite simple in its construction, is capable of performing a large amount of work. The roll of paper to be cut into strips is placed on a shaft at the rear of the machine, and is passed alternately over and under the rolls in the pivoted frame at the top of the machine, thence between circular shears to the shaft that receives the strips. This shaft is rotated by power received through the belt, and the circular shears are turned by the paper itself, which passes between elastic rollers on the shear shaft. Tension is given the paper by a friction brake on the shaft which holds the paper supply. The rollers in the pivoted frame smooth and stretch the paper, and the shears make a clean cut without danger of tearing the paper. The machine will cut paper strips of any desired width and wind them in solid coils, and it may be adapted to paper of any thickness from the finest tissue to cardboard.

The manufacturers inform us that only one attendant is required, and that the expenditure of less than one horse power will cut into strips of any desired width at least 4,000 lbs. of paper in ten hours and wind it perfectly. The machine might be easily combined with a paper machine so as to cut and wind the paper as it comes from the calender without the necessity of rewinding, in fact it seems a very important adjunct to paper machines designed to manufacture paper in rolls.

This machine was recently patented by Mr. Ignatz Frank, and is manufactured by the Cutting and Winding Machine Company, No. 124 Baxter street, New York city, Mr. George W. Gilbert, Secretary.

NEW CUT-OFF FOR STEAM ENGINES.

We give herewith an engraving of an engine provided with an improved cut-off recently patented by Mr. George H. Cobb, of Palmer, Mass. In this engine a single slide valve is operated by the joint action of two eccentrics, one of which is secured to the main shaft, while the other moves freely in a longitudinal direction upon the governor shaft, but is prevented from turning thereon by a slot in the eccentric and a feather in the shaft.

The cam or eccentric on the governor shaft is graduated, so that its center varies in position at every point in its width, the eccentricity passing around from one side of the shaft to the other. The governor acts upon the movable eccentric and varies its position according to the speed of the engine.

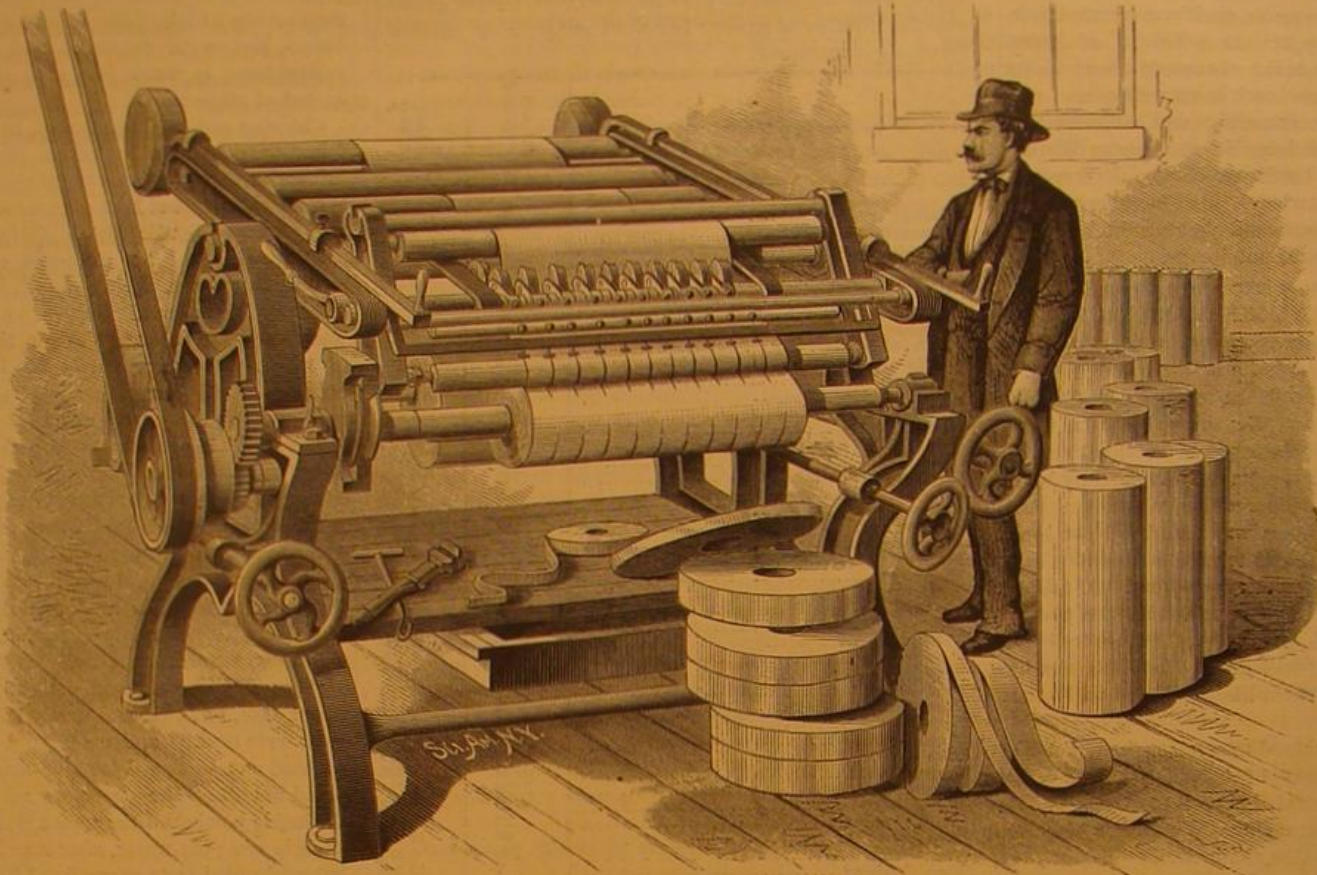
The straps of the two eccentrics are connected with a link or lever, which is fulcrumed on the lever that operates the slide valve of the engine, and the governor takes its motion from the main shaft through miter gearing.

It is a very simple matter to adjust the cut-off to the speed of the engine, the adjustment depending on the relation of the governor arms with the movable eccentric. This device appears practical; it certainly is very simple, and

possesses the advantage of being applicable to engines already in use.

The Nobility of Science.

And as to nobleness of character, how can one accuse science of striking at it when he sees the minds that science forms, the unselfishness, the absolute devotion to life work that she inspires and sustains? With the saints, the heroes, the great men of all ages we may fearlessly compare our men of scientific minds, given solely to the research of truth, indifferent to fortune, often proud of their poverty, smiling at the honors they are offered, as careless of flattery as of obloquy, sure of the worth of that they are doing, and hap-

**FRANK'S PAPER CUTTING AND WINDING MACHINE.**

py because they possess truth. Great, I grant it, are the joys which a firm belief in things divine confers, but these the inward happiness of the wise equals, for he feels that he toils at an eternal work and belongs to the company of those of whom it is said, "Their works do follow them."—*Renan's Inaugural Address.*

OYSTERS in China are frequently dried for use instead of being eaten fresh. They are taken from the shells, plunged for an instant into boiling water, and then exposed to the rays of the sun until every particle of moisture has evaporated, when it is said they will keep for a length of time, while preserving the full delicacy of their flavor. The finest and fattest bivalves, bred on the leaves and cuttings of the bamboo, are chosen for this process, those taken from the natural beds being inferior in quality, and not sufficiently plump for the operation.

Wooden Pendulums.

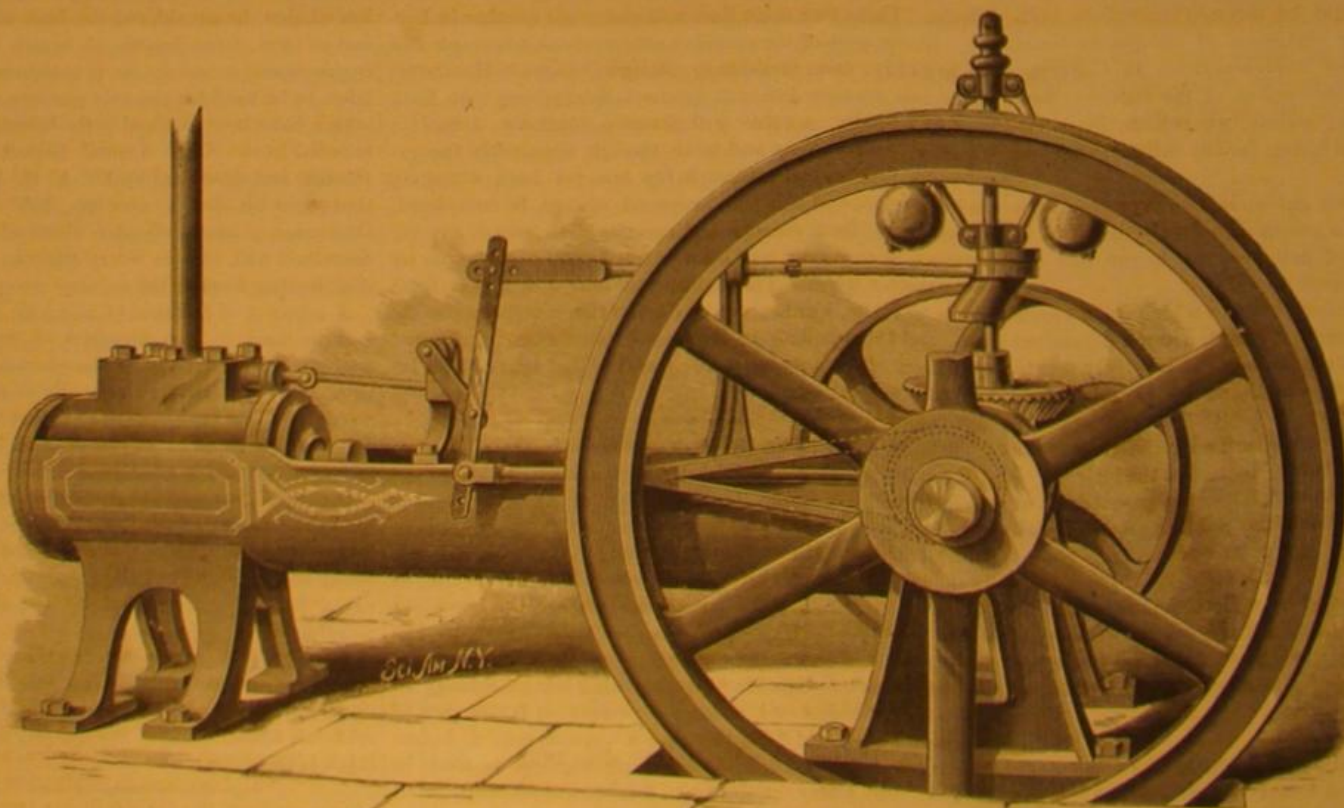
An interesting discussion recently took place at a meeting of London clock makers on compensation pendulums. The general judgment seemed to be in favor of plain wooden pendulums for all sorts of timepieces. One speaker said that wooden pendulum rods were generally in use for turret and church clocks, and also in regulators. Another concurred in that statement, and he thought that if wooden pendulums were good for church clocks, they might usefully be adopted for bracket clocks. He had accordingly altered a very old family clock of that description, and of the best London make, by substituting a wooden for a brass pendulum, with very decided advantage. It might

possibly be worth while to make a similar alteration generally; brass, being a cheaper and a prettier material, having probably been used by the makers of bracket clocks without consideration. A third maker never used anything but wood, when he could help it, for railway, church, or turret clocks. Another speaker considered that one of the advantages in the use of wood for pendulums might be that, in a fall of temperature, when the rod would be shortened, the hygroscopic property of the wood would come into play, which would tend to lengthen it, and so cause a natural compensation by the thermometric and hygroscopic properties of the wood acting in opposite directions. In some climates that certainly might be the case, though in others they would work together, when the effect would be to increase

the error. It was stated that a wooden pendulum with a leaden bob had been affixed to a regulator clock in one of the leading shops, and was keeping excellent time. It was a very simple form of pendulum, and might be made very economically. Further testimony was borne to that form of pendulum. Dr. Mann had used one in Natal, which was simply a rod of varnished wood supporting a cylindrical bob of lead. It was, of course, subjected there to great and rapid changes in the atmospheric pressure and to diversities of heat, but it worked excellently for many years. Subsequently it was replaced by one of Frodsham's best steel pendulums, and though there was some improvement, it was much slighter than might have been expected. In short, it was about as good a pendulum as could be conceived.

A Curious Property of Heat.

Mr. C. J. Henderson has been conducting some experiments lately in Edinburgh with a view to finding out what is the most economical way of heating a public hall, and has decided that the best results are to be obtained by using an accumulator or stove-room, where the heat, generated by any means whatsoever, is collected, and from which it is discharged through one opening about three or four feet square and seven or eight feet from the floor. The experiments unexpectedly exhibited with what instantaneousness and equality heat is transmitted through space independent of the direction in which the entering heated air is moving; for thermometers were placed at the same height on each of the four

**COBB'S IMPROVED CUT-OFF.**

walls of the hall which was to be heated, and it was found that just as the heated air entered from the stove room so the mercury in the several thermometers rose, whether they were hung on the same wall in which was the opening to the stove room, or on the north wall, fifty feet away.

THE KANCHIL, OR PYOMY MUSK.

BY DANIEL C. BEARD.

Last winter while we New Yorkers were bringing into requisition all modern appliances within our reach to ward off the cold waves that came rolling over us from the mountains and plains of solid ice of the northern frozen regions, while our ears and nose, our fingers and toes, were tingling in the frosty air of midwinter, the crew of the good ship Janet Furguson were sweltering under the burning rays of a tropical sun. The ship was on her return trip from Singapore to New York with a cargo of pepper and spices. When passing through the Straits of Sunda she was met and surrounded by the usual fleet of native bum boats laden with fruits and curiosities. Among the miscellaneous cargo of these sea peddlers' boats one had aboard some of the most graceful, beautiful little creatures one could well imagine—five full grown live deer, not larger than small rabbits. The captain of our Janet Furguson after some parley succeeded in purchasing them, giving in exchange an old silver watch. The

are nocturnal in their habits, and are often surprised by the natives in the act of making a raid upon the sweet potato patches, and captured by throwing sticks at their legs or caught in nooses; in the latter case they frequently escape by feigning death.

The Malays prize them both as articles of food and as domestic pets. It is of this species that a rather doubtful story is told to the effect that when closely pursued by the hounds they will leap into the overhanging branches of some friendly tree, and hang suspended by their large canine teeth until the too eager foe rushes by, then dropping to the ground they will calmly retrace their steps. It is said that the creatures can make most extraordinary leaps, and that they display great cunning. They have no musk bag, and like the rest of the family are destitute of horns. The antlers we see upon stuffed specimens in the windows of the taxidermist are artificial.

The doe in my possession measured 15 inches in length: the head rather large, being $4\frac{1}{2}$ inches from point behind the ears to tip of its nose; nose movable, always wet and cold like a pointer dog, and like that dog she possessed a keen scent. The round, short ears gave the animal the appearance of a mouse. The canine teeth were short, slender, and sharp, and, unlike the buck's, did not extend below the lips. The ten inch mark upon the rule came above the highest part of her

4th. The number of rigs erected and being erected at the close of the month exceeds that of any previous month.

5th. The amount of crude produced in the month was larger than in any previous month since the commencement of the business.

6th. The amount of stock in the producing region exceeds the amount ever before held.

7th. The shipments out of the region were larger than in any corresponding month in the past.

8th. The price of crude at the wells ruled lower than in any corresponding month since 1862.

The annual report of the Chief of the Bureau of Statistics on commerce and navigation for the fiscal year ended June 30, 1878, is at hand, from which we make the following extracts:

A larger percentage of the mineral oil product of the country is exported than of any other product, except cotton.

Petroleum ranks fifth in value among the exports of the United States, as shown by the following statement of the five principal commodities exported during the fiscal year ended June 30, 1878:

Cotton.....	\$180,031,484
Wheat.....	96,872,016
Pork, bacon, hams, and lard.....	86,679,979
Indian corn.....	48,000,358
Petroleum and products of.....	46,574,977



THE KANCHIL, OR PYGMY MUSK.—(*Tragulus Pygmaeus*.)

ship's carpenter soon built for them a convenient little house, about the dimensions of a small dog house, with "Deer Lodge" neatly painted over the door, and in these comfortable quarters the little midgets made in safety a voyage of 136 days, becoming great favorites with the crew. One fawn was born during the trip, but when discovered by the mate of the vessel the buck had eaten off its legs and it was dead.

Arriving off Sandy Hook the Janet Furguson encountered a cold wintry gale, all hands were kept busy, and during the confusion three of the little creatures that had managed to escape from their snug little house perished with the cold. Immediately after arriving at port the fourth, a fine buck, fell a victim to our (to them) inhospitable climate. The only survivor, a beautiful doe, represented in the above drawing, came into my possession; but she only lived about a week. In spite of all my care she too expired, killed by the cold breath of our New York winter.

She was a timid little creature, and although perfectly tame objected to being handled, but she would take food from my hand and allow me to stroke her back. She had the pose and action of our ordinary deer. When watching her as she leaped over a footstool, or stood, head erect, with one fore foot gracefully poised, in an eager, listening attitude, or crept timidly and stealthily close to the wall and behind the articles of furniture, it was as difficult to realize that it was a real live deer as it is to believe that the midget General Mite is actually a living specimen of the genus *homo*.

The pygmy musk is common in the peninsula of Malacca and the neighboring islands, frequenting the thickets. They

back. The legs were extremely delicate: a Faber lead pencil looked thick and clumsy beside them. The tiny hoofs only measured two-eighths of an inch at the broadest part, where the cloven parts united. The color is a general reddish brown, darker upon the back, where the hairs are tipped with black; an indistinct dark band runs from a point between the ears to nose; rather stiff gray hairs upon the sides and back of neck; fawn colored sides; three white streaks under part of neck; soft white hair upon belly and the anterior upper part of hind legs and the posterior upper part of fore limbs; the lower jaw is also white.

These animals could in all probability be acclimated in our Southern States, especially in Florida, abounding as that State does in swamps and thickets, where the animals could secure coverts and breed.

Progress of Petroleum.

The result of the operations in the producing regions of Pennsylvania for the month of March is, says *Stonell's Petroleum Reporter*, certainly surprising, to use a very mild expression. They reveal a state of affairs that have never before existed in the oil regions, and we think gives very little hope for the immediate future. The following facts appear:

1st. That there were more wells drilling at the close of the month than in any corresponding month since 1870.

2d. More wells were completed during the month than in any month since November, 1878.

3d. The daily average production of the new wells was larger than in any previous month of which we have record.

It has been ascertained as the result of careful computations that the quantity of petroleum and its distilled products exported during the year ended June 30, 1878, was equivalent to 407,482,175 gallons of crude oil, or in other words, that the exports of petroleum constituted about 66 per cent of the entire amount produced.

25.58	per cent was shipped to	Germany.
13.97		the United Kingdom.
11.34		Belgium.
5.09		Italy.
5.08		France.
4.70		the Netherlands.
34.24		all other countries.

Of the total exports 82.24 per cent was exported to Europe, 11.75 per cent to Asia, Africa, and Australia, 0.52 per cent to the British North American Provinces, 5.28 per cent to Mexico, the West Indies, Central America, and South America.

Total exports of petroleum and its products from the United States from January 1, 1879, to April 4, 59,756,732 gallons; same time in 1878, 50,630,744 gallons; increase in 1879, 9,125,988 gallons.

The daily average production for the month of March, 1879, was 47,615 barrels, against 38,980 barrels for March, 1878, which is an increase of 8,635 barrels, or about 22 per cent, to which add 9·4 per cent produced in 1878 more than was needed for the export and home trades, and we have an increase of about 31·4 per cent in production to be provided for.

The exports from the United States from January 1, 1879, to April 4, 1879, were about 18 per cent more than were exported in the same time in 1878.

Should the present rate of 22 per cent increase in production be kept through the year, which it now bids fair to do, and the present rate of 18 per cent increase in exports maintained, we will have at the close of 1879 an overwhelming amount of stock on hand, except new markets shall be found, which will increase the export demands; or new uses, which will increase the home trade.

The number of producing wells at the close of March, 1879, was 10,692. The number of drilling wells completed in March was 338. Total production in March, 1,476,065 barrels; the average daily production of the new wells in March was 21 1-10 barrels; the average daily production of all the wells for the month was 4 1-10 barrels.

The stock in the producing regions has been increased during the month, 502,186 barrels, making the total stock at the close of the month 6,294,849 barrels, and is held by pipe companies, tankers, and operators.

RECENT MECHANICAL INVENTIONS.

An improved washing machine, which does its work principally by pressure upon the clothes, has been patented by Mr. Charles P. Rood, of La Fargeville, N. Y. The machine consists of a tub having a number of deep transverse ribs in the bottom, and a fluted roller carried back and forth over the bottom by a carriage worked by a rack and pinion.

An improved clothes pounder, which acts by forcing air through the clothes, has been patented by Mr. C. F. K. Wilson, of Seymour, Iowa. It is designed to clean the clothes without rubbing.

An improved animal trap, which is designed to be set over a barrel set in the ground and partly filled with water, has been patented by Messrs. N. H. Williams and L. Chapman, of Murrayville, Ill. The trap readjusts itself after having caught an animal.

Mr. Peter H. Baker, of San Francisco, Cal., has patented an improved door latch, which may be used simply as a latch or it may be locked with a key, which will prevent the withdrawing of the latch.

An improved hand truck, in which the bearer bars, to which the axle is bolted, and the back guard are made in one piece and bolted to the inner flanges of angle iron side bars, has been patented by Mr. Thomas Hill, of Jersey City, N. J.

Mr. Frederick Hollick, of New York city, has patented an improved vehicle wheel, having a flanged tire and felloes provided with radial spokes, which are secured in the divided hub in a novel and substantial manner.

An improved guide for harness makers' sewing machines, which enables the machine to be used in sewing up seams in round lines, has been patented by Mr. James W. Hollingsworth, of Paoli, Ind.

An improved press, for baling cotton and other similar materials, has been patented by Mr. E. F. McGowen, of Houston, Texas. This invention consists in a novel arrangement of gearing for operating the press without changing the motion of the driving shaft.

Messrs. D. W. and H. Johns and Henry Embs, of New Albany, Ind., have patented an improved machine for making ox-polls. In this machine the ox-polls are made by the rolling process, the iron bar being first bent into a V-shape and the eye formed; the ends or flanges are then closed by stationary dies as the poll comes from the roll.

Messrs. C. H. Lane, W. A. Hutchins, and John McGrew, of Garnettsville, Ky., have devised an improved washing machine, which consists of two hollow cylinders provided with longitudinal ribs and arranged to rotate in contact with each other.

An improved machine for operating a clothes pounder or churn dasher has been patented by Mr. P. C. McCune, of Mount Etna. A revolving platform supports the tub or churn, and a reciprocating lever carries the pounder or churn dasher, as may be required.

An improved carriage wrench, which consists essentially of a socket wrench divided longitudinally, the two parts being jointed together and provided with adjusting screws, has been patented by Mr. E. A. Robbins, of Fairfield, Me.

Mr. Abner Hart, of Ogden, Ill., has devised an improved washing machine, which is provided with recessed pounders having air pumps attached, and with foot levers in connection with hand levers for operating the pounders.

An improved machine for operating a churn, turning a grindstone, sawing wood, and for other applications where a small power is required, has been patented by Mr. E. H. Drake, of Horseheads, N. Y. The invention consists in a novel arrangement of a weight and gearing.

Mr. Charles B. Hill, of Nashville, Tenn., has patented an improvement in middlings purifiers. This machine, which seems simple and effective, cannot be described without diagrams.

Mr. John B. Overmeyer, of New Lexington, O., has devised an improvement in time locks, which is so arranged that in case the watch movements which control the main bolt should stop the lock may still be opened from the outside at a certain fixed time.

An improvement in vehicle axles, patented by Messrs. Thomas Reichelderfer and Peter W. Wertz, of Longswamp (Mertztown P. O.), Pa., consists in a novel splice connection for securing the axle spindle to the axle.

An improved heat regulator, patented by Mr. E. S. Gary, of Baltimore, Md., is operated by the expansion and contraction of a fluid acting on a piston connected with the damper of a stove or furnace.

Mr. Henry Reese, of Baltimore, Md., has patented an improved wrought iron railway tie, having upturned lugs for

holding the rail and provided with an ingenious looking device for preventing the displacement of the rail.

A novel mechanical movement for converting motion either for an increase of power or speed has been patented by Mr. Theodore Scholze, of Angola, Ind.

Cast Steel Armor for Ships.

The material of which thick armor should be made, says Mr. Barnaby, is now the subject of anxious experiment in Germany and France, as well as in Italy and England. Steel and other alloys of iron are so little known or understood, that there is a large field for experiment open for the armor plate maker and for the artilleryman. Steel has been tried many times alone, and in combination with iron, but it never gave enough satisfaction to secure its adoption until experiments were made at Spezia with plates 55 centimeters thick, manufactured by Schneider & Co., at Creuzot. With these the Italian Government were so well pleased that they are plating the Dandolo and Duilio with such plates. Those of us who visited the French Exhibition last year may have seen a steel armor plate produced by this firm, bent to the form of a turret, 32 inches thick, and weighing 65 tons. Those who went to the works at Creuzot, by favor of Mons. Schneider, may also have seen an ingot of cast steel, suitable for making an armor plate, and weighing 120 tons. The rival firm of Terre Noire exhibited armor plates of steel which had not been hammered, or rolled, or otherwise forged. They were simply cast plates, tempered in oil, and annealed. Judging from the admirable series of specimens and tests and analyses, the manufacture has already attained a large degree of precision, and is full of promise. I believe that the Italian Government will shortly test some of it with the big Elswick gun, and it may be that blocks of cast steel will revolutionize the manufacture of armor by making the rolling operations unnecessary, and bringing down the cost to that of ordinary large castings. The French Government have also made many experiments with steel armor at Havre, but have not yet satisfied themselves that they should give up wrought iron. Experiments with steel in England have shown that steel can be made of great hardness, so hard that it will break up all projectiles which strike it, and that will not suffer seriously in doing so. Sir Joseph Whitworth has obtained some most remarkable results in this direction, and he is still pursuing the inquiry.

NATURAL HISTORY NOTES.

Winter Habits of the Eel.—It is well known that the eel will, of its own accord, leave a pond or stream and wander overland to another locality. This occurs, says Dr. C. C. Abbott, in the *Science News*, usually when the hot summer's sun has evaporated the water of the pond in which the fish happens to be, or so lessened its bulk that the eel finds the locality no longer suited to its wants. In such a case the animals leave the stagnating waters of a land-locked pond, and, with a serpent-like motion, pass through grass well wetted with dew or showers. They seem to exhibit a sense of direction in their movements, and always head for the nearest stream. These land migrations are more frequent during evenings, when a heavy dew is deposited, than at other times. In watching the progress of the work in clearing a piece of meadow land on March 8th, Dr. Abbott was surprised to find, in a mossy mass of earth and roots, through which water from a neighboring spring circulated (though not in sufficient quantity to enable any fish to swim in it), a group of eels, seventeen in number. They were not in a tangled mass, so intermingled as to suggest that they sought contact for mutual warmth, but each was coiled in a snake-like manner by itself. On taking them up they seemed sluggish, and made no effort to escape until revived by the warmth of the writer's hand, when they struggled to get free. When given their liberty they wriggled in a very direct line for the nearest point at which they could reach the ditch hard by. Two of the fishes were dissected, and the amount of matter in their stomach was so small that Dr. Abbott believes that they had been fasting during their semi-aquatic sojourn in the place where they were detected. Subsequent close examination of the spot showed that the spring water did not, and had not, run as a stream through it. There was every indication that these eels had voluntarily left the ditch, fifty feet distant, and sought out this spring hole, which from its southern exposure and constant supply from the spring was a comfortable spot. The question arises: is this a common occurrence, and do eels hibernate habitually, choosing the soft, muddy bottoms of our deeper ponds and the tidal portions of our rivers?

A Green Spored Toadstool.—As well known to botanists the *Agaricini*, or toadstool, tribe is primarily divided into five series, according to the color of the spores. These series are: the white spored (*Leucospori*), pink spored (*Hyporhodii*), brown spored (*Dermini*), purple spored (*Pratella*), and black spored (*Coprinarii*). Hitherto no species of toadstool belonging to the several genera into which the order is divided has been known to occur with mature spores of any other color than some shade of those above noted. Recently Mr. C. H. Peck has detected a species of *Agaric* with green spores. Until some other species shall occur with spores of this color he is disposed to assign this anomalous specimen to a place among the white spored species, to which in structure it appears to be related.

Self-Fertilization of Plants.—The Rev. Geo. Henslow, after a thorough study of the subject, claims that Mr. Darwin's works have gone too far to strengthen the belief that intercrossing is absolutely necessary for plants, and that if self-

fertilization be continued for lengthened periods the plants tend to degenerate and thence to ultimate extinction. This he believes to be absolutely false. In an article in the *Popular Science Review* he gives the following conclusions: 1. The majority of plants can, and possibly do, fertilize themselves. 2. Very few plants are known to be physiologically self-sterile when the pollen of a flower is placed on the stigma of the same flower. 3. Several plants are known to be morphologically self-sterile, in that the pollen cannot, without aid, reach the stigma, but is effective on that of the same flower. 4. Self-sterile plants from both the above causes can become self-fertile. 5. Highly self-fertile forms may arise under cultivation. 6. Special adaptations occur for self-fertilization.

The "Digger" Mollusk and its Parasite.—The pretty little shellfish, the "digger" (*Donax fossor*), not uncommon on our New York coast, represents a countless mass of life off Cape May, New Jersey, large areas looking like barley grains lying on a malting floor when the tide retires. The mollusk gets uncovered by the breaking surf and immediately reburies itself with its powerful foot when the waves retire. The siphons are long and active, looking like so many wriggling worms. Although the prey of shore birds and fishes, and beset with parasites, they lie so thickly as even to interfere with one another in burying themselves. The liver of these bivalves is always found beset by flukes, from half a dozen to several dozen, and a bell-shaped trichodina crowds the branchial cavity.

The May-bug in Europe.—The grub of the May-bug or May beetle (common to Europe and America) is perhaps, with the exception of the phylloxera, the most destructive pest the French husbandman has to contend against. At a recent sitting of the Central Horticultural Society, of Paris, it was stated by the head gardener at Chantilly that they were destroying the roses. One hundred and eighty-seven days' labor were expended upon about an acre of ground, each man disabling 5,000 of these insidious grubs daily, the total amounting to close upon a million. Another member stated that he had had upward of half a million collected on every hectare of his estate.

These beetles, according to old accounts, were at one time as great a plague in England as the locust is in America. A writer in the *Philosophical Transactions* states that on February 24, 1574, there fell such a multitude of these insects into the river Severn that they clogged and stopped the water wheels. Further, they are told in the *Transactions* of the Dublin Society, that the country people in one part of the kingdom suffered so greatly by the devastations made by these insects that they set fire to a wood some miles in length, which parted two adjacent counties, to prevent them dispersing themselves any further that way.

The Age of Seeds and the Sex of Flowers.—At a meeting of the Botanical Society of France, M. Duchartre called attention to a statement of M. F. Cazzuola in the Bulletin of the Tusculan Horticultural Society, in 1877, to the effect that melons raised from fresh seed bear a large proportion of male flowers and very few female flowers; while, on the other hand, seedlings raised from old seed bear many more female flowers than male. The statement was confirmed by M. Millet, a French grower; and, it may be added, by the experience and practice of gardeners in England (on the authority of the *Gardeners' Chronicle*).

Should the English Sparrow be Protected?—These birds, which have now proved such a nuisance in America, seem to have no friends at present except those few persons who were instrumental in introducing them. The English themselves warned us against the pest. Not long ago a great outcry was raised against them by the farmers in Algeria, and now we have the same evil report of them from the kingdom of Saxony. A recent English paper says that "the Council of Agriculture of the latter country has decided to petition the government to repeal the law which makes it an offence to destroy them. Indeed the feeling against sparrows has become so strong in some parts that the inhabitants have decided to destroy them in defiance of the law. It is asserted that a microscopical examination of their crops proves that sparrows live upon grain during eight or nine months of the year, and are only insectivorous when reduced to it by necessity. It is the same cry from far and near, from America and Australia, where the 'dissolute, unmusical rover' has been introduced and protected by stringent enactments, in return for which he was expected to eat a great many insects and very little else."

The Effect of a Sea Voyage on Animals.—Most of the wild animals procured for the menageries and zoological gardens of Europe and America are brought from Africa via North Germany by Mr. Reiche, the proprietor of the New York Aquarium. They are brought from Africa (mainly as cubs) to Trieste and thence to North Germany, and from there they are distributed to countries where they are wanted. These animals are usually brought to the United States by the North German steamers, and it is interesting to learn about their habits on shipboard. Charles Reade, the novelist, always inaccurate when he goes out of his way as a writer of fiction to dip into science, has stated that the sagacious elephant in storms at sea saves himself from being washed off the deck by throwing himself flat upon his belly, with extended legs and trunk outspread with suction power upon the planks. Captain Nevnaber, however, says that no shipmaster would undertake to carry a loose elephant on deck, because tumbling about in a gale he would be a more dangerous object than the loose gun told of by Victor Hugo.

The elephant, of all other wild animals transported by steamer, are confined in the strongest kind of boxes, and the boxes themselves are secured in the firmest manner. In a storm the lions, tigers, and hyenas prove the greatest cowards. They also suffer a great deal from seasickness, and whine about it. The elephant utters few sounds when he is seasick, but he sways his great head from side to side, and looks "unutterable things." The horse is the most nervous and sensitive animal that goes to sea, and a hen shows the most utter disgust with life when seasick, by vomiting and eccentric movements.

THE CALAMAR.

Besides the different varieties of sepia the calamar, *Loligo vulgaris*, is the most remarkable member of the family of Decapoda. The fleshy, naked cylindrical body is somewhat elongated and conically pointed toward the back. The two fins are united on the back and impart to the animal the form of the point of an arrow. In the back is contained a flexible horny shield. The first pair of arms is shortest, next follows the fourth, then the second and third pairs. The additional two grasping arms, peculiar to all decapoda, are nearly twice as long as the body; and their thickened ends are lined with four rows of sucking disks. The predominating color of the calamar is a brilliant carmine red.

The calamar is very common throughout the Mediterranean and on the coasts of the Atlantic, and especially during the fall numerous swarms are met with, counting many thousand individuals. Sometimes large numbers are caught in the nets prepared for catching large fish.

The wanderings of the calamar depend upon those of swarms of numerous small fish which form its nourishment.

The weight of the calamar frequently reaches twenty pounds; individuals weighing more are occasionally found, sometimes reaching a length of two feet and a half. The mean length is about eight inches.

During his sojourn at Naples Brehm had ample opportunity to study the habits of the calamar in the aquarium as well as in the sea, and states that the animal's habits are quite unlike those of the sepia.

On several occasions from ten to sixteen individuals were placed in the tanks of the aquarium, but they invariably died in a short time, having spent their few days of imprisonment in continuous monotonous motion.

While the octopus and sepia are easily acclimatized in the aquarium and propagate themselves, the calamar seldom lives over two days in imprisonment.

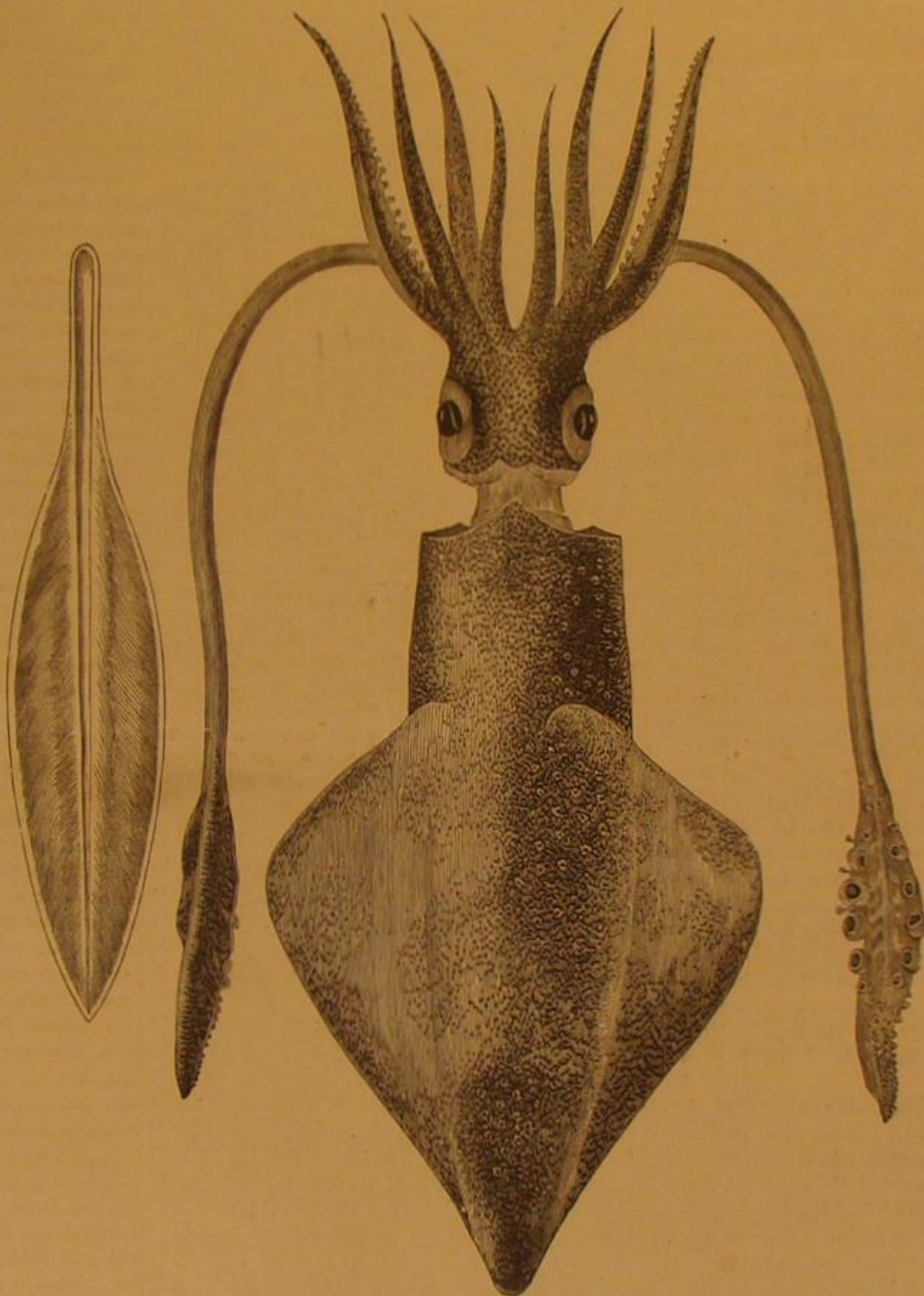
Like the octopus and sepia, the calamar forms one of the principal articles of diet of the inhabitants of Italian seaports. In Naples, and in fact all the cities and villages situated on the coast, they are offered for sale in the public markets. The animals of medium size are preferred, as their meat generally has the most agreeable taste. When injured or excited, the calamar changes its beautiful red color and turns successively violet, green, and yellow, which gradually changes again into crimson. This behavior the Naples fishermen make use of to demonstrate the freshness of their fish to their customers. The calamar is not killed, but left to die gradually while being exposed for sale. When a customer calls, a small incision is made in one of the arms; the animal changes its color immediately, and the customer is satisfied.

Notes on the Apple Worm.

Mr. J. Savage, of Lawrence, Kansas, in a recent number of Colman's "Rural World," remarks upon the freedom of Michigan apples from the work of the apple worm (*Carpocapsa pomonella*). This same freedom was generally noticed in 1878, not only in Michigan, but in many parts of New York, and it doubtless obtained elsewhere. It will be well for us to endeavor to arrive at the reasons. To my mind the following, first stated by me in the New York Tribune, may very properly be urged: 1. The very general failure of the apple crop in 1877, as exemplified in the report for that year which we find both in the Proceedings of the Michigan Pomological Society and in those of the American Pomological Society. This failure was in many localities so nearly total that scarcely any apples were grown, and it follows, as a consequence, that very few codling moths were produced to perpetuate the species the following year. A

second reason, so far as Michigan is concerned, may be found in the fact that in no State in the Union have more intelligent and persevering efforts been made to prevent its ravages. Through the columns of the agricultural and horticultural journals, as well as in the pages of their Pomological Transactions, the simple methods of fighting this pest, that have been reported and recommended in the Missouri Reports, have been persistently kept before the people, while Professor Beal, of the Agricultural College, has, perhaps, done more good than any one else by showing that it cost him no more than 4 cents per tree to keep the bands around the trunks, changing them every nine days in the warm months, from the first appearance of the worm until the end of August, in an orchard of 250 trees. I agree with him when he asserts that "if a man will not take the trouble to keep his fruit from the worms he deserves to eat wormy apples."

Missouri apple growers should take courage from these facts. Since my connection with the Department of Agri-



THE CALAMAR.

culture there have been sent to me four different kinds of patent bandages to be used as traps for this apple worm, but I can find no advantage in any of them over the simple paper bandages, first recommended by me in 1872 and since very generally employed.—Professor C. V. Riley, before the late annual meeting of the Missouri State Hort. Soc.

Powder Barrel Boring Insects.

Captain McGinnis, U. S. A., has recently communicated to the editors of the *American Naturalist* specimens of an insect (probably *Callidium variabile*) which have been found to injure the hickory hoops of the powder barrels in the St. Louis Powder Depot. So injurious has this gnat proved that no inconsiderable sum is now annually spent by the Government in re-coopering barrels in order to make good the damage thus done. Means have been taken to prevent the further ravages of the insect.

Tucker and Avery's Anti-friction Journal Bearing.

This invention was erroneously described in our issue of May 3 as Avery's anti-friction journal bearing, whereas it should have received the above title.

Mr. Avery states that it was the suggestion in the SCIENTIFIC AMERICAN of the necessity of such an invention that led him to invest in it, and that it was not invented at the suggestion of the SCIENTIFIC AMERICAN, as stated in the article referred to.

The Cotton Worm.

One of the most valuable papers read before the recent session of the National Academy of Sciences was that by Prof. C. V. Riley on the hibernations and migrations of *Aletia argillacea*, the parent of the cotton worm which has for years devastated the cotton fields of our Southern States. Professor Riley says that this foe to agriculture has received but little intelligent study, and that this is somewhat surprising considering the great losses suffered from its ravages. A careful examination of these losses, which he has lately been making from the most reliable published statements and from the returns of numerous correspondents, shows that this one insect alone, during a year when it is generally prevalent, may injure the crop to the amount of \$30,000,000, and that the average actual annual loss during the fourteen years since the war has been about \$15,000,000. There is good evidence, also, to show that its injuries were equally severe before the war.

The use of Paris green, recommended by Professor Riley in 1873, has, he says, partially protected the crop, but the use of arsenical preparations is too expensive and unsafe to afford general protection.

Among the other difficulties in the way of efficient protection is the lack of sufficient knowledge of the habits of the foe to be encountered. Regarding the hibernation of the species three theories are worthy of consideration. (1) That it hibernates in the chrysalis state; (2) that it hibernates as a moth; (3) that it hibernates only exceptionally in any of our cotton growing States, but comes into them on the wing from warmer climates where the cotton plant is perennial.

At first blush it would seem easy enough to dispel whichever of these theories is erroneous, and settle the question under consideration by a few simple facts of observation. The trouble, however, is to get at the facts.

After detailing the observations relied on to support the various theories enumerated, Professor Riley rejects the first, and is unable to choose between the last two. He says:

"Regarding the migrating powers of the moth there is abundant and satisfactory evidence. The last brood of moths, appearing late in autumn, are especially apt to migrate beyond the cotton belt, and consequently far beyond the region where they can perpetuate their species, if, as all the facts indicate, it can live upon no other plant than *Gossypium*. I have received the moths taken as far north as Racine, Wis., where they occurred in such numbers as to ruin acres of cantelopes by puncturing them with the proboscis and sucking the juices. Similarly the moth has been found on the Atlantic coast, hundreds of miles away from the nearest cotton plant. This power of extended migration being therefore proved and admitted, it is but natural to conclude that the insect comes each year from some country where the cotton plant is perennial, as, for instance, the Bahamas; and there are other facts which lead to this view."

"To sum up our present knowledge bearing upon the subject, it is safe to conclude that the insect does not hibernate in the chrysalis state. The evidence would also seem to militate against the possibility of hibernation even in the moth state. Yet there are so many well attested cases of the moth being seen flying during mild winter weather that the question cannot by any means be considered as settled."

English Saddle Horses.

The requisite qualifications of an English lady's saddle horse, according to the *Agricultural Gazette*, London, are as follows: Here all the caprice of fashion and the weight of the breeder's intelligence are concentrated. The great aim being to secure an animal light in the hand, springy in his paces, with that due proportion of bone and sinew which will bear wear and tear, because ladies, once up, unless thorough horsewomen, think, "Oh, he is a horse, and he must go!" I can almost challenge the seller on the point whether the horse has carried a lady by observing the unequal wear of the forelegs. The near leg in cantering bearing all the concussion, is often very looped, if not archy, in comparison. In this class of horse length of limb and pastern joint is desirable—long pasterns, good knees, deep shoulders, deep, blood like quarters, the feet sound, hoof dark colored.

Hydraulic Gold Mining in California.

During a recent visit to this city, one of the largest hydraulic miners of California, Mr. John H. Thomas, explained quite fully the methods and prospects of the hydraulic and drift mining enterprises of that State. The business he pronounced in its infancy, though it had already yielded something like \$300,000,000. "There are yet square miles of unexplored gravel, and of the gravel beds actually explored, tunneled, drifted, and opened, not one-twentieth have been worked. The Union, a drift mine, averaged over \$40,000 per acre. The Down East, also drift, got over \$300,000 from six acres." "This," continued Mr. Thomas, to a *Tribune* reporter, "has been about the average of our drift mines, which, working only three or four feet of the gravel nearest the bed rock, got from \$2 to \$13 per cubic yard, at an average expense, including improvements, of about 25 per cent of the product, when paying \$3 to \$4 a day for miners. Our hydraulic mines show averages of 12 cents to 60 cents a cubic yard, and there are from 10,000 to 200,000 cubic yards per acre; an average in the main channel of 80,000 to 100,000 cubic yards an acre. An inch of water, about 2,000 cubic feet, with head of 100 to 200 feet, will wash from 3 to 4 cubic yards a day, and costs from 2 cents to 10 cents an inch."

In an interview with a writer for the *American Exchange*, Mr. Thomas described at greater length the geology of the gravel beds, and the manner in which they are gleaned of their stores of precious metal.

Feather, Nelson, Slate, and Onion Valley creeks and the Yubas, all head in a group in a ridge whose peaks are called Washington Hill, Pilot Peak, Mount Fillmore, Table Rock, Grizzly Mount, and others. All these are within a region of twenty miles square in Plumas and Sierra counties, Cal., and are from 6,000 to 7,000 feet high, on the western slope of the Sierra Nevada range. The parallel of latitude running through Virginia City and Gold Hill, Nevada, and through the greatest upheaval of gold and silver veins known, passes through this group of peaks about fifty miles west, and extends to the gold bluffs on the coast, where the western rim of the continent turns back to the northeast and southeast. From this group of peaks a line parallel with the coast runs southeast through the main gold leads of California, and fifty miles further east a second parallel would run through the main gold and silver leads of Nevada, Arizona, and Mexico.

The geological formation and topography of the country seem to point to this ridge between Virginia City and these groups of peaks as the mineral shed or peak of the West—or the point of main upheaval of the precious metal deposits of the Pacific mountain ranges. The main hydraulic and drift mines of California are upon what are known as the Blue, White, and Gray leads. These leads are to all appearances the channels of rivers that in past ages took their head at this group of peaks, and ran southeastward. Alluvial, glacial, and volcanic action filled these channels, first with sand and gravel, then covered them with lava, when the channels seem to have been lifted up, and even mountains tumbled upon them, while the region to the east became the higher part of the Sierras. These had their peaks, and being lower and sloping to the west, the rivers of modern times run westward nearly at right angles, cutting new channels or cañons, and leaving parts of the old channels near the tops of mountains from 200 to 3,000 feet above the beds of the rivers of to-day.

These washings from the old channels, swept down toward the Pacific, formed the deposits in the bars and gulches that enriched the "Forty-niners" and their immediate followers, who, washing up the streams to find the source of the enormous deposits of gold, ran into the mountains looking for quartz veins until at last the old channels were found. The modern deposits in bars and gulches were worked out, and the impression is prevalent abroad that the gold gravel beds of California are exhausted, when the truth is that the real gravel deposits of the State were only lately found, and, large as has been the aggregate yields of gold gravel in California, enough is now known of these old channels to show that only a very small portion of their wealth has been removed.

These three main channels—the Blue, White, and Gray—so named from the prevailing shade of the gravel, starting from the points named, extend southward to the lowlands some seventy-five miles, then on to the ocean, lying in a belt about thirty miles wide. The White and Blue, often running together, are the main channels, and are from 300 to 3,000 feet wide and from 5 to 200 feet deep, averaging from 60 to 80 feet where best defined. These channels or beds meander, are shallow and deep, narrow and wide, like the beds of running rivers, and have banks, shores, or rims of country rock, slate, and granite. These "rims" must generally be pierced with tunnels that strike the bottom of the channels and afford an outlet out of which the gravel can be carried or washed.

The bed or channel itself can only be ascertained—being covered over by mountains, lava, loam, and forests—by tunnels from rim to rim, and shafts from surface to bed rock. When the body of gravel is thus accurately determined, and its average value found by testing all parts exposed, the next thing is to decide on the manner of mining. If the gravel is covered with only a few feet of loam or lava, it can be done by hydraulic power, that is, by a stream of water with a force of 100 to 300 feet fall directed against the bank. If the bed should be covered with too much rock or lava to do this, then it is "drifted"—mined like coal, the gravel car-

ried out and emptied into a sluice or flume, through which water washes it. The third step is to get the necessary water. Very little water is required for drift mining, but for hydraulic a vast quantity and a fall of 100 to 300 feet are necessary. The unit of water measure is a "miner's inch," or the amount of water that will flow in twenty-four hours through a hole one inch square with six inches pressure—about 2,000 cubic feet. For effective work there should be at least 1,500 inches. Each inch of water will move from 3 to 5 cubic yards of gravel per day, and as a mine uses from 1,000 to 5,000 inches, it washes down from 3,000 to 25,000 cubic yards per day. Such a bulk of detritus would soon choke up any ordinary river channel, and equally important to successful hydraulic mining is a free escape of the gravel washed, or a "dump." This provision nature has furnished in some cases, notably near the head of the great leads, in the deep ravines made by the modern rivers, which here fall for long distances at an angle of 45°, and from 500 to 2,500 feet below the beds of gravel washed.

Although these gravel deposits are almost unlimited, it requires large, organized facilities to realize. While a miner with a pick, shovel, and pan or rocker was force and equipment enough for old-fashioned gulch mining, really effective hydraulic or drift mining requires a large working force and an equipment that costs many thousands of dollars. When Mr. Thomas first went to California, twenty years ago, they were just washing out the gulches next to the great leads, and some were drifting into the channels near bedrock, but found the gravel too high; then water was brought in by sluice boxes, and six-inch canvas hose with half inch nozzle, under 75 feet pressure, were thought large affairs. Soon iron pipes were introduced, first six inch, then twelve, and more recently thirty-six, and even forty-four inch pipe, and from a few hundred feet of canvas pipe we have now in one mine nearly 90,000 feet of thirty-six inch iron pipe. With the introduction of iron pipe, the nozzles were gradually enlarged, and the Little Giant, a large cast iron nozzle working on a swivel joint, was introduced.

Craig discovered that by rifling the Little Giant, the jet, instead of whirling and expanding, shot out straight, retaining its full force. Then Hoskins invented the second joint to the Little Giant, which enables the raising or lowering of the nozzle, and under several inventions a nozzle has been perfected, the largest of which can be moved in any direction by a child; one of eight inches, with 200 feet head, capable of moving 3,000 cubic yards per day, being operated by one hand with ease. Thus one man, with perfect ease, moves as much gravel in a day as 1,000 men could with shovels and cars.

But to attain this effectiveness frequently requires vast expenditures. Ditches must be run from ten to sixty-five miles, carrying from 500 to 5,000 inches of water. These ditches cost from \$20,000 to over \$500,000, and one is now being built by the Pioneer Company that will cost, when completed, \$1,250,000. The plans of several companies have cost from \$1,000,000 to \$2,000,000. The most of these have been completed within the last five or eight years. Hydraulic mining has been carried on in California for twenty years, but the first ten years was mainly used in experimenting and organizing.

Mr. Thomas' operations having been chiefly about the head of the Blue lead, the largest and richest of the gravel beds, he was naturally most inclined to talk about that. This is not only the richest gold region in California, but probably in the world. This district also possesses peculiar advantages for hydraulic mining. The channels being highest there, the heavier particles of gold are found, just as the largest nuggets are the first to sink when the gravel is floated by moving water. The ravines are deeper and the descent more rapid than lower down, enabling us to build a series of grizzlies and undercurrents, through which the gravel is strained and repeatedly washed, until almost every particle of gold is freed and is caught. Undercurrents are merely sluices placed in steps, so that the gravel falls from one to the other. Grizzlies are heavy iron grates which catch the boulders and through which the gravel is sifted; they are placed at the point where the washings fall into the sluice. The gravel miners were some years in perfecting this system, and now can save fully 30 per cent more gold than in earlier years.

A New Metallic Paint.

Mons. C. M. Jacob, of Paris, obtained a prize medal at the French Exhibition for a metallic paint which, according to our foreign contemporaries, possesses valuable qualities for a variety of purposes. There is no substance, it is claimed, requiring coloring matter to which it is not applicable.

One of the most important features of this invention is its adaptability for capsuling any kind of bottles or jars containing liquids or viands. The colors employed for the various purposes are not confined to any particular shade, and when on, the articles painted with them have all the appearance of different colored bronzes. The liquid paint having been poured into an ordinary utensil, the neck of the bottle, when properly corked, is dipped into it, and removed almost as quickly as in the waxing process; the paint appears to set instantly, is dry in three minutes from the time it is applied, and becomes quite hard in about one hour. It can be branded in the usual manner, the marks being indelible, and the most important effect claimed is that the bottle becomes hermetically sealed, which is not the case with an

ordinary capsule. If the properties of this new production are not overrated, it will, no doubt, play a most important part in many other articles.

The National Academy.

The proceedings of the first two days of the annual meeting of the National Academy of Sciences were reported two weeks ago. On the morning of the third day four new members were elected, namely, Professor Cleveland Abbe, of Washington, well known by his meteorological researches and as a mathematician; Dr. Horatio C. Wood, of Philadelphia, an eminent physiologist and botanist; Professor J. W. Gibbs, of Yale College, a distinguished physicist and professor; and W. G. Farlow, of Harvard University, eminent for his scientific researches.

In the afternoon the following papers were read: "On the Stability and Instability of Drainage Lines," by G. K. Gilbert; "On a New Polariscope Method for the Detection and Estimation of Dextro-glucose in Cane Sugar and Inverted Sugar," by Professor C. F. Chandler; "On the Ignition of High-tension Fuses," by General H. L. Abbot; on "Hibernations and Migrations of Aletia Argillacea, the Parent of the Cotton Worm," by Professor C. V. Riley; on "Two New Forms of Micrometer," by Professor E. C. Pickering; "Report on Dredgings in the Caribbean Sea, on the Coast Survey Steamer Blake," by Professor Alexander Agassiz; and on "Physical Hydrography of the Gulf of Maine," by Professor Henry Mitchell.

Professor Agassiz's report of his dredging operations in the Caribbean Sea during the past year was extremely interesting. He had, he said, verified a theory held by him for some time regarding the necessity and utility of deep sea dredging—that almost all the fauna found at the greatest depths by the Challenger expedition are also to be found in a depth of not more than 2,500 fathoms. The work of the Challenger had been confined to dredging at great depths, and occupied about two and a half years, while he, on a small steamer of 350 tons, had been able, in a few months, to make a collection of deep sea fauna second only to that of the Challenger expedition, and approaching near to it in respect to completeness and variety. Professor Agassiz, therefore, concludes that it is not necessary, in order to procure most of the deep sea fauna that frequent great depths, to extend the operations of dredging much beyond 2,500 fathoms, while a great majority of the forms are found much within that limit. Professor Agassiz then discussed the question of a sunken continent once occupying a great share of the area of the present Caribbean Sea, and connecting the West India islands with the coast of Central and South America. He offered some interesting theories respecting the flow of the Gulf Stream and its causes, which differ materially from the explanations usually given.

On the fourth day (April 18) the following papers were read: "The Winds on Mount Washington Compared with the Winds near the Level of the Sea," by Professor Elias Loomis; "On a Mineral Locality in Fairfield County, Conn.," by Professor J. G. Brush; "On the Great Silver Deposits recently Discovered in Colorado, Utah, and Nevada," by Professor J. S. Newberry; "On the Influence of Jupiter upon Bodies Passing near the Planet," by Professor H. A. Newton; "On the Recurrence of Solar Eclipses," by Professor Simon Newcomb; "On Projections of the Sphere which Preserve the Angles," by Professor C. S. Peirce, and "An Account of the Geodetic Arcs Determined by the Coast Survey, in Relation to the Figure of the Earth," by Professor J. E. Hilgard.

The Velocity of Light.

At the U. S. Naval Academy, Annapolis, Ensign A. A. Michelson has begun (under orders from the Naval Department, and with funds supplied by Mr. A. G. Hemmway, of New York) the erection of apparatus for the more accurate determination of the velocity of light. The method to be employed by Ensign Michelson is described as essentially that of Foucault, with the exception that a lens of great focal length and a plane mirror are used instead of a concave mirror. This arrangement permits the use of a considerable distance, giving a longer interval of time, and insuring greater accuracy. The displacement of the image of a slit is the quantity to be measured, and this in Foucault's experiments was a fraction of a millimeter—and the velocity of light could not be determined with any greater accuracy than could this displacement—which would be a fraction of one per cent. In the experiments made at Annapolis by Ensign Michelson the displacement has been increased to over one hundred millimeters. Hence, the error introduced by this measurement would be less than one thousandth of the whole, or less than twenty miles.

Another, though not an essential feature, is the use of a tuning fork, bearing a mirror on one prong and kept in motion by a current of electricity, by means of which the speed of the revolving mirror can be ascertained with the same degree of precision. The mirror is put in motion by a blast of air furnished by a small rotary blower, which is turned by a steam engine. By this means a very steady speed is maintained. The entire apparatus is now nearly complete, and in two or three weeks the observations will be begun.

THE President of the British Iron and Steel Institute, Dr. C. W. Siemens, announces that the Council of the Institute have conferred upon Peter Cooper the Bessemer gold medal of 1869, in recognition of his eminent services in the promotion of metallurgical science.

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 unequalled 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.

The best results are obtained by the Imp. Eureka Turbine Wheel and Barber's Pat. Pulverizing Mills. Send for descriptive pamphlets to Barber & Son, Allentown, Pa.

Valves and Hydrants, warranted to give perfect satisfaction. Chapman Valve Manuf. Co., Boston, Mass.

Steam Tug Machinery, Engines, Boilers, Sugar Machinery. Atlantic Steam Engine Works, Brooklyn, N.Y.

Kimball's Catarrh Cigarettes, an instantaneous relief and a pleasant smoke. They contain no tobacco.

"We get 10 lb. more steam since using 'Downer's Boiler Liquid,'" writes a party who appreciates the merits of the above article. Clean boilers, with more steam and less fuel, is the verdict. A. H. Downer, 17 Peck Slip, New York.

The Globe (Miner) Street Lamp; most durable, none better. Address J. G. Miner, Morrisania, N. Y. City.

For Sale.—Two Horizontal Engines, 50 and 25 H. P.; Price \$675 and \$450; are first-class, new, and complete. Address H. Nadig & Bro., Allentown, Pa.

Steam Hammers, Improved Hydraulic Jacks, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Drop Hammers, Die Sinking Machines, Punching and Shearing Presses. Pratt & Whitney Co., Hartford, Ct.

Air Guns.—H. M. Quackenbush, Manufacturer, Herkimer, N. Y.

Boilers ready for shipment. For a good Boiler send to Hilles & Jones, Wilmington, Del.

Wanted.—Estimates for Manufacturing Coleman's Mill Pick, advertised in another column.

The only Portable Engines attached to a boiler having cold bearings. The Peerless and Domestic. Francis Hershey, successor to F.F. & A.B. Landis, Lancaster, Pa.

For one dollar, with your chest measure, we will send, post paid, a pair each of our O. K. Shoulder Braces and Bonanza Armlets. J. W. Smith & Co., 178 Devonshire St., Boston, Mass.

H. W. Johns' Asbestos Roof Paint forms the most durable and economical protective coating in the world for tin roofs, exposed brick walls, iron work, barns, fences, etc., for which it is in every respect equal to the best white lead, while it costs only half as much. It is made in a variety of beautiful colors, samples of which will be sent on application to 87 Maiden Lane, New York.

Lightning Chisel Pruner. Centennial award. For sale or royalty. Address Flournoy, Knowles, Md.

Magnets, Insulated Wire, etc., for experiments. Catalogue free. Goodnow & Wightman, 175 Washington St., Boston, Mass.

Shaw's Mercury Gauges, 5 to 50,000 lbs.; accurate, reliable, and durable. T. Shaw, 215 Ridge Ave., Phila., Pa.

New Pamphlet of "Burnham's Standard Turbine Wheel" sent free by N. F. Burnham, York, Pa.

17 and 20 in. Glibed Rest Screw Lathes. Geo. S. Lincoln & Co., Hartford, Conn.

Sheet Metal Presses, Ferracute Co., Bridgeton, N. J.

Vertical Burr Mill. C. K. Bullock, Phila., Pa.

Excelsior Steel Tube Cleaner, Schuykill Falls, Phila., Pa.

Diamond Drills, J. Dickinson, 64 Nassau St., N. Y.

A Cupola works best with forced blast from a Baker Blower. Wilbraham Bros., 2315 Frankford Ave., Phila.

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

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

The Ornamental Penman's, Engraver's, Sign Writer's, and Stonecutter's Pocketbook of Alphabets; 32 plates; 25 cts; mail free. E. & F. N. Spon, 446 Broome St., N. Y.

Linen Hose.—Sizes: 1½ in., 20c.; 2 in., 25c.; 2½ in., 30c. per foot, subject to large discount. For price lists of all sizes, also rubber lined linen hose, address Eureka Fire Hose Company, No. 15 Barclay St., New York.

Dead Stroke Power Hammers; cheapest and best for general forging and die work; 500 in. use. P. S. Justice, of Philadelphia.

Forsyth & Co., Manchester, N. H., and 213 Centre St., New York. Specialties.—Bolt Forging Machines, Power Hammers, Combined Hand Fire Engines and Hose Carriages, new and 2d hand machinery. Send stamp for illustrated catalogues, stating just what you want.

Partner Wanted.—A party with limited capital.—Address Des Moines Linseed Oil Works, Des Moines, Iowa. Presses, Dies, and Tools for working Sheet Metal, etc. Fruit & other can tools. Bliss & Williams, B'klyn, N. Y.

Nickel Plating.—A white deposit guaranteed by using our material. Condit, Hanson & Van Winkle, Newark, N.J.

Needle Pointed Iron, Brass, and Steel Wire for all purposes. W. Crabb, Newark, N. J.

The Lathes, Planers, Drills, and other Tools, new and second-hand, of the Wood & Light Machine Company, Worcester, are being sold out very low by the George Place Machinery Agency, 121 Chambers St., New York.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing Metals. E. Lyon & Co., 479 Grand St., N. Y.

Solid Emery Vulcanite Wheels.—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 39 Park Row, N. Y.

Portland Cement.—Roman & Keene's, for walks, cisterns, foundations, stables, cellars, bridges, reservoirs, breweries, etc. Remit 25 cents postage stamps for Practical Treatise on Cements. S. L. Merchant & Co., 53 Broadway, New York.

For Sale.—7 foot bed Putnam Planer, \$350. A. A. Pool & Co., Newark, N. J.

Pulverizing Mills for all hard substances and grinding purposes. Walker Bros. & Co., 23d & Wood St., Phila., Pa.

Steel Castings true to pattern, of superior strength and durability. Gearing of all kinds. Hydraulic cylinders, crank shafts, cross heads, connecting rods, and machinery castings of every description. For price list and circular, address Chester Steel Castings Company, 407 Liberty St., Philadelphia, Pa.

Walrus Leather for Polishing Agricultural Implements and all kinds of metal. Greene, Tweed & Co., N. Y.

Elevators, Freight and Passenger, Shafting, Pulleys, and Hangers. L. S. Graves & Son, Rochester, N. Y.

Machine Cut Brass Gear Wheels for Models, etc. (new list). Models, experimental work, and machine work generally. D. Gilbert & Son, 213 Chester St., Phila., Pa.

Holly System of Water Supply and Fire Protection for Cities and Villages. See advertisement in SCIENTIFIC AMERICAN of this week.

Diamond Self-clamp Paper Cutter and Bookbinders' Machinery. Howard Iron Works, Buffalo, N. Y.

Best Power Punching Presses in the world. Highest Centennial Award. A. H. Merriman, W. Meriden, Conn.

Electro-Bronzing on Iron. Philadelphia Smelting Company, Philadelphia, Pa.

Improved Steel Castings; stiff and durable; as soft and easily worked as wrought iron; tensile strength not less than 65,000 lbs. to sq. in. Circulars free. Pittsburg Steel Casting Company, Pittsburg, Pa.

For Shafts, Pulleys, or Hangers, call and see stock kept at 79 Liberty St., N. Y. Wm. Sellers & Co.

Wm. Sellers & Co., Phila., have introduced a new Injector, worked by a single motion of a lever.

Rubber Hose, Suction Hose, Steam Hose, and Linen Hose; all sizes. Greene, Tweed & Co., 18 Park Pl., N. Y.

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.

NEW BOOKS AND PUBLICATIONS.

THE COMBUSTION OF COAL. By W. M. Barr. Indianapolis: John Brothers. 8vo. pp. 306. \$2.50.

Mr. Barr has done good service by presenting in plain English such information with regard to the chemistry of coal, and the more recent mechanical devices for the economic use of solid, liquid, and gaseous fuels, as may be of practical utility to the great mass of fuel users. He has not aimed to present new theories or new observations, but rather to bring the knowledge, already established, within the reach of those unprepared by mathematical and chemical training to profit by the excellent but abstruse treatises of Professor Rankine and others. The book is well written, illustrated with a few appropriate cuts, well made, and fully indexed.

VICK'S ILLUSTRATED MONTHLY.—The current number of this floral magazine is full of handsome illustrations and pleasant reading matter. The frontispiece is a collection of small flowered petunias, and it includes every known variety. The grouping is artistic and the coloring exceeding rich. The Monthly is devoted exclusively to flowers and vegetables, and every page is filled with information regarding growing plants and roots. The magazine is devoted mostly to the culture of flowers. The magazine teaches the development of the beautiful, and were half its suggestions followed the world would be a garden of roses and the people in it bright and happy. Mr. Vick is an enthusiast and his spirit is seen in all he writes. The Floral Guide for 1879 has just been issued; it contains a full page colored illustration of lilies and numberless illustrations of smaller proportions, and representing a great variety of plants, flowers, and vegetables. Both magazine and Guide are published at Rochester, N. Y., by James Vick.

Notes & Queries

HINTS TO CORRESPONDENTS.

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

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

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

Correspondents whose inquiries do not appear after a reasonable time should repeat them.

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

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

(1) R. G. S. asks for the process of hardening and tempering small steel instruments (dental). A. Heat them to a cherry red and immediately plunge them

into a cake of tallow, resin, or beeswax, according to the size of the tool or temper required.

(2) R. R. S. asks: 1. For best and cheapest method of case hardening axles. A. Pack the axles in an iron box with animal carbon, into the box with clay, and heat it to a red heat. This temperature must be maintained for several hours, according to the depth of the hardness required. 2. Also the best mode of giving axles a fine polish while revolving in centers. A. Make a grinding clamp and line it with lead. Apply fine emery and oil to the axle and hold on the clamp, moving it along the axle as it revolves.

(3) C. P. W. asks for an explanation of the use of the "scale of chords." A. It is chiefly used for measuring angles. Refer to some geometrical work for explanation of the rule.

(4) R. S. H. writes: I have seen wheels made, or rather used, for gumming saws, by fastening emery on to wooden wheels in some way. Can you tell me how to do it? A. Coat the wheels with good glue, and roll them in emery heated to about 300° Fah. Solid emery wheels are far better than the kind you mention.

(5) A. L. writes: I have a flute, the first joint of which is ivory, and where it comes in contact with my lips it is very much discolored. Can you tell me how to color the ivory an indelible black or some dark color, something that will not injure the flute or poison my lips? A. Suspend in a strong aqueous solution of neutral silver nitrate exposed to direct sunlight until black; then wash thoroughly with water.

(6) G. J. V. asks: 1. How to overcome that nuisance, bedbugs. A. Try benzine—a very small quantity will suffice. 2. Am troubled also with rats and mice, which have become too shrewd to be taken in by any device of mine for destroying them. A. Dr. Ure recommends the following: Melt in a bottle by standing it in water heated to about 150° Fah., ½ lb. of lard, to which add ¼ oz. of phosphorus, and ¼ pint of proof spirit. Then remove the bottle from the water bath, cork, and violently agitate it for a minute or two. On standing the dilute alcohol separates and may be poured off, while the rest, made fluid by gently warming, is made into a dough with wheat flour and sugar, and flavored with oil of rhodium or aniseed. Pellets of this dough are placed in the rat holes, and as they shine in the dark and are pleasant to taste and smell, they are readily eaten by rats and mice and prove certainly fatal. There is no danger of fire from the use of this mixture if properly prepared.

(7) H. A. J. asks how to remove the stains from the front of a brick house caused by white paint washing off of the window frames and running down the bricks. Also the green mould that has collected on the bricks, back of an old porch roof, now taken down. A. Apply a strong solution of caustic potash or soda, and after a few hours wash with plenty of clean water.

(8) R. M. C. asks the best method of making an electro-magnet to sustain a heavy weight by the use of one "carbon" or "Daniell" cell, and how long will either of the above cells sustain its strength on a closed circuit without attention? A. You cannot expect to sustain a great weight with a single small cell of either battery. We think, however, that a magnet having ½ inch cores, 2½ inches long, each wound with 10 or 12 layers of No. 20 wire, would give good results with a single cell. The carbon battery will run down in a short time. The Daniell will keep up for three or four months.

(9) G. W. L. asks: If a lead pipe attached to a common lifting pump be flattened one half of its diameter through its whole length, will the pump work as freely and throw as much water in a given time? A. If the pipe, before being flattened, is only sufficient to supply the pump, no.

(10) R. B. asks how to grind in a faucet plug. A. Drawfile the plug, and grind with the sand that is rapped from castings, or with grindstone grit and water.

(11) F. A. S. asks: 1. What is the proportion of the peroxide of manganese, carbon, and gum lac used in the new form of Leclanche batteries described in SUPPLEMENT No. 159? A. Use only enough shellac to cement the particles together. You can determine the proportion by an experiment. 2. Will gas carbon ground fine do for the carbon used in the carbon blocks made of the above mixture? A. Yes. 3. If I take a block of wood made the same size and shape that the rubber blocks are (between the zinc and carbon), and soak it in hot beeswax and coat it over on the outside with beeswax, will it not answer the purpose? A. Yes. 4. What is the size of Right transmitter for telephones, diaphragm thin holding the carbon, and size of spring? A. The size given in the engraving on page 186 of current volume of SCIENTIFIC AMERICAN is correct.

(12) E. C. P. asks: What metal expands most when heated (mercury excepted)? A. Zinc, among common metals.

(13) G. W. G. asks for the number of minor planets now known. A. Professor Swift informs us that there are 194.

(14) N. C. L. writes: I have a boat 28 feet long over all, 6½ beam, will draw about 2 feet, it is sharp fore and aft, like a whale boat, very strongly built. I have a steam fire engine boiler, 10 to 12 horse power. I want to make 10 to 12 miles an hour. If I carry 100 lbs. of steam, how large should the engine be? Would 4½x7 inch cylinder be about right? A. 4½ inches by 7 inches would answer, but 5 inches by 8 inches would be better. 2. The boat having a sharp stern, would you advise the use of two propellers, one each side? A. Two screws to be preferred.

(15) S. M. H. writes: 1. I noticed in the SCIENTIFIC AMERICAN, some time since, that antimony could be used in the place of carbon in single fluid batteries. Would you use two antimony plates with zinc between, or two zinc plates with antimony between? A. You will find carbon more satisfactory than the antimony. Use two carbon plates with one zinc plate between. 2. How many such cells would be required for ordinary medical use? A. Very strong current is not required. A. One cell is sufficient.

(16) C. A. W. asks: 1. In the condenser of induction coil, described in SUPPLEMENT No. 160, are

both surfaces of the tin foil coated; that is to say, if each sheet were 1 foot square, would there be 20 or 40 sheets? A. 40 sheets. 2. I wish to make an electro-magnet about 3 inches long; what is the best diameter for core, and also what size wire and how much should I use? A. Half inch cores. If the magnet is intended for experimental purposes, probably six or eight layers of No. 18 wire will answer. 3. I wish to run a line with a friend about 800 feet off. Which will be the cheapest, a line of copper (about No. 20 or 18) or regular telegraph wire? A. Telegraph wire. 4. Which will have the more resistance? A. For the same size, iron has the most resistance; this is compensated for by using a larger wire. 5. How many gravity cells would it take to run it? A. It depends on the arrangement of your line, your instrument, etc. Probably four would answer.

(17) C. Y. & Co. ask for a copper dip, such as used by certain fixture manufacturers on their iron castings. A. Copper sulphate, 3½ oz.; sulphuric acid, 3½ oz.; water, about 1 gallon. Place the clean casting in a tumbling barrel with sawdust, bran, or sand moistened with this solution, and revolve for a few minutes; a longer exposure will spoil rather than improve the film of copper deposited. In place of tumbling the articles, they may be simply rubbed with this mixture.

(18) J. K. asks: 1. If an electric light can be maintained in a vacuum. A. Yes; the Geissler tube, the electric egg, and the Sawyer-Man lamp are examples. 2. It is stated that the wonderful Kansas and Colorado Centennial clock runs a hundred years with one winding up, and that the weight or weights of this clock has a fall of 6 feet and falls ¼ of an inch in a year, and takes less power to run it than a watch. Now, perhaps a clock might be geared to run a hundred years, but the complicated machinery would cause so much friction that it would require a great deal of power. I doubt very much if it would ever stir, the friction would be so great. Now I would like to have the SCIENTIFIC AMERICAN's opinion about this wonderful clock; is it a humbug or is it not? A. There is very little friction in the clock referred to, the escapement and pendulum operate very slowly.

(19) J. C. A. asks: How does the microphone magnify small sounds? A. By varying the electrical current so as to produce in the receiving instrument greater sonorous vibrations than those at the microphone or transmitter.

(20) W. A. R. asks: What is the cheapest and easiest method of etching on glass? And how are the etching fluids prepared, and will the fluids used to etch glass produce the same results on metals? A. Glass is etched by hydrofluoric acid gas or liquid hydrofluoric acid (solution of the gas in water). The former in contact with glass produces a rough surface (as in ground glass), while the latter ordinarily leaves the surface clear. The gas is prepared by mixing together finely powdered fluor spar (calcium fluoride), 3 parts, and 2 parts of strong sulphuric acid, in a shallow leaden dish, and applying a gentle heat. The plates to be etched may be placed over the dish. The operation should be conducted under a hood or in the open air to avoid inhaling the pernicious fumes. The plates are prepared by coating them while warm with wax or paraffine, through which to the surface of the glass the design is cut with suitable gravers. In preparing the liquid acid the mixture of spar and oil of vitriol is placed in a leaden or platinum retort, which is heated, and the gas given off is conducted into a leaden bottle filled with water, which absorbs it. In contact with the flesh the acid produces stubborn sores. The metals are usually etched with dilute nitric acid and nitre, or sulphuric acid, sulphate of copper and salt, hydrochloric acid and chloride of potash. Hydrofluoric acid is not used on metals.

(21) E. D. V. asks: 1. Of how many grains does the drachm consist? A. Apothecaries' weight—1 dr. = 60 grs., or ¼ troy pound. 2. In patent office formula, when not specified, how are we to understand drachm or dram, as avoidupois or apothecaries? The same question concerning the use of the word drachm or dram in these columns. I understand it, when not otherwise specified, to mean always 27 and eleven thirty-seconds grains. Am I correct? My drug-gist disputes me. A. Usually, the old apothecaries' drachm of 60 grains is understood, although in modern pharmacy (U. S.) the pound, drachm, and scruple have fallen into disuse, while in chemical formulae the metric system is now almost exclusively employed. The avoidupois drachm is now seldom used.

(22) N. D. writes: In finishing some stores I want a large quantity of counters, 400 or 500 feet. Black walnut is dear; white wood in wide boards is much cheaper and sufficiently hard and smooth. How can I stain this wood so as to resemble cherry, mahogany, or black walnut? A. Water, 1 quart; washing soda, 1½ ounce; Vandyke brown, 2½ ounces; bichromate of potash, ¼ ounce. Boil for ten minutes, dilute with water if necessary, and apply hot with a brush.

(23) A. J. B. asks: 1. How are carbons for batteries made? A. See SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 157, 158, and 159. 2. How are porous cups for batteries made? A. They are made of potter's clay, baked without glazing. 3. How is the best and cheapest battery made which will do for nickel or silver plating? A. For plating on a small scale use a Daniell or a gravity battery. A full description of these batteries is given in the SUPPLEMENTS referred to above.

(24) H. J. G. asks (1) how to make a good diamond wheel for grinding, polishing, and sharpening diamonds? I would like to make a wheel to fit into my foot power lathe. A. Use a flat soft iron disk. Burnish the diamond dust well into it. 2. What color must I have when drawing the temper of a square center for centering in lathe? A. A brownish yellow.

(25) J. A. D. asks: Can a six horse power engine employed in a cheese factory, at the foot of a hill, be used with advantage for cutting and grinding feed in a barn 35 rods distant, on the summit of the hill? If so, what means of connection should be used? A. You can readily do it by employing a small endless wire rope, allowing it to run over a sheave at the factory, and over another sheave at the barn. Any dealer in wire rope will give you plans.

(26) C. L. V. writes: I have been gathering carnellians and agates for quite a while. Having a nice collection now, I should like to polish them. Will you please tell me if there is any other way or method of polishing them besides cutting them? If so, what is the method? A. You may shape your carnellians with a corundum wheel such as is commonly used by dentists, and they may be tolerably well polished on a fine Arkansas oilstone fitted to the lathe.

(27) J. P. J. writes: I wish to build a scow about 60 feet long, and 18 or 20 feet beam, and 4 feet hold, decked over forward and not to draw over 3 feet of water when loaded. 1. Could I put on a stern wheel and successfully propel it by steam, at the rate of 3 or 4 miles per hour? A. Yes. 2. If so, about what horse power engine would it require, or would I have to use two smaller engines? A. One engine, 9 inch cylinder by 2½ feet stroke, or two equal to this in power. 3. Would an upright boiler answer, and what size? A. Yes; consult a good engineer as to size and proportions. 4. What size should the wheel be? A. 9 to 10 feet diameter. 5. And about how many paddles? A. Ten. 6. Would it be better to have it longer and less beam? Will a square bow answer? A. Longer and less beam would be better; a square bow will answer for a light draught.

(28) A. H. asks: 1. Is crude petroleum superior to coal for smelting iron? A. If it could be practically and economically applied, yes. 2. If so, is it used for that purpose to any extent? A. No. 3. Is iron ore with 60 per cent of iron and 5 per cent of sulphur a good ore for smelting, say with petroleum? A. No. 4. What back numbers of the SCIENTIFIC AMERICAN contain information about petroleum; iron smelting with petroleum, and is there any book published about iron smelting with petroleum? A. See pp. 352, 69, 90, 368, and 85, vol. 39, SCIENTIFIC AMERICAN. We know of no such book.

(29) W. J. H. asks for a compound used to harden iron. A. Heat the iron to a cherry red, dust on powdered yellow prussiate of potash, and plunge in cold water.

(30) "Subscriber" asks if a pipe 12 feet high, 6 inches diameter, be filled with water, the pipe to be made of material just strong enough to hold the water, would a pipe of same height, capable of holding three times the amount of water, have to be of stronger material? A. If of same height, yes.

(31) W. K. H. writes: Let us suppose a 10x12 engine, running at 200 revolutions, 400 feet piston speed, with a 5 foot driving wheel. Then a 10x24 engine, 100 revolutions, same piston speed as above. Now, to communicate the same speed to the driven machinery we must have a 10 foot driver, which exactly balances the leverage gained by the stroke. Am I right? A. Yes.

(32) J. S. S. writes: In "Notes and Queries," April 19 (11), you say: "J. W. W. asks: 1. What degree of centigrade is water at its greatest density? A. 4°, equal 39°2° Fah." In "The Depths of the Sea," by Prof. C. Wyville Thomson, Macmillan & Co., London, 1874, the author says, on page 306, that on the cruise of the Lightning, August, 1868, he found the temperature at the bottom of the sea—12° centigrade; and on the cruise of the Porcupine, August, 1869, page 309, he found—13° centigrade, more than 5° centigrade lower than the answer to J. W. W. A. The fact that the temperature is below 4° cent. at the bottom of the sea does not prove that the density of the water is greatest there. Water is practically incompressible, and expands both above and below 4° cent.

(33) A. K. writes: I want to make an induction coil like the one described in SUPPLEMENT No. 160. I have made the tube out of maple wood, ¾ of an inch internal diameter and fifteen sixteenths of an inch external diameter. 1. Will this do? A. Yes. 2. Should it be varnished? A. Yes. 3. Must the hammer be soft iron? A. Yes. 4. How many thicknesses of thin writing paper should I put around each coil or layer of the secondary coil? A. Four. 5. Should it be varnished? A. Not necessarily. 6. What battery is the best as regards strength, durability, and cost? A. Probably the Grenet will answer your purpose best. 7. How many will I need for the coil to get the best results? A. Three, of good size.

(34) A. M. S. writes: Suppose a wood planer to have a cylinder 5 inches in diameter, with 3 knives set at an angle of 45° with the radius, and making 4,000 revolutions per minute. Will such planer cut any smoother or better with the edge of knives projecting only ½ of an inch over chip break, than it would with the knives projecting five sixteenths or three eighths of an inch? A. Yes.

(35) S. E. M. writes: I wish to make an ink that will copy several days after writing with it. A. Use a strong aqueous solution of soluble nigrosin (a variety of aniline black soluble in water), containing a few drops of clove oil to prevent moulding.

(36) J. W. P. asks what the Italian statuary or image makers put in their plaster of Paris so as to make it resemble marble. Some of their wares are very finely cast with a fine outside polish. A. Saturate the dry cast with melted (pure) stearine or stearic acid.

(37) B. A. M. asks: 1. Is not aniline red a poison? A. Pure fuchsian or magenta is hurtful, if not poisonous, when taken into the system in any considerable quantity. The commercial aniline red often contains traces of arsenic, owing to the employment of arsenic acid in its production. 2. Are there no means of neutralizing it without spoiling the wine which contains it? A. No. 3. How can it be detected in wine? A. See p. 344, vol. 39, SCIENTIFIC AMERICAN, and pp. 892, No. 54, 593, No. 59, and 637, No. 40, SCIENTIFIC AMERICAN SUPPLEMENT.

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

E. D. B.—It is difficult to determine a plant from such material alone, but we are very positive that it is one of the milkweeds, probably the very widely distributed *Asclepias cornuti*. If so, we may state that numerous partially successful attempts have

hitherto been made to obtain from the tough stems of the plant a textile fiber and a paper stock. The plant, although common, is not found in sufficient abundance in a wild state to afford any very great supply. We are not aware of any experiments that have been made to ascertain whether its cultivation would prove profitable; if you have facilities it would be an interesting matter to devote a little land and time to its cultivation to find out this.—J. B. B.—No. 1. The rock is a serpentine. The crystals appear to be alundite and prehnite—quantity too small for proper classification. No. 2. Graphitic granite. Nos. 3 and 4. Hornblende and feldspar. In No. 3 the red crystals are garnets. No. 5. A ferruginous clay containing carbonaceous matters.—No. 6. Doleritic rock. No. 7. Chiefly calcite containing marcasite. No. 8. Coal shale.—L. W.—It is an impure clay—aluminum silicate—containing much lime carbonate, iron oxide, magnesia, and traces of alkaline chlorides. If properly washed it might be serviceable in the manufacture of bricks, tiles, drain pipes, cheap pottery, etc. It cannot be used for soap making, as the per cent of alkalies is very small.—J. A. S.—It is an impure alum—of some value if found in any considerable quantity. An analysis would be requisite to determine its actual value.—C. F.—No. 1. A schistose conglomerate. No. 2. Ferruginous sandstone. Ground, washed, and calcined, this may produce a cheap bright red pigment.

COMMUNICATIONS RECEIVED.

On Motion of Perimetral Points in a Rotating Shifting Wheel. By J. P. B.
On Squaring the Circle. By G. M. A.
On the Polar Sea. By F. G. N.
On Canals. By J. S. B.
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Wagon Wheel Question. By S. N. M.
On Mosquitoes. By E. P.
On Cipher Writing. By J. W. W.
On Rose Hips. By C. F. E.
On Lunar Calendar. By J. D. S.
On Life Saving Apparatus. By Nauticus.
Machine for Covering Wire. By J. B.
On Telephones and Sounders. By H. H. E.

[OFFICIAL.]

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Granted in the Week Ending
April 8, 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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Sewing machine attachment, J. C. Herr, Phila., Pa.
Sounding board for pianofortes, A. H. Wood, N. Y. city.
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Watch cases, E. C. Fitch, New York city.
Wheel for vehicles, F. Hollick, New York city.

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THE

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Hancock Inspirator.

[LETTER.]

Office of the Hancock Insp. Co.,

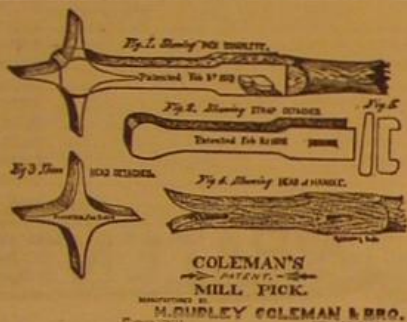
London, Eng., Feb. 11, 1879.

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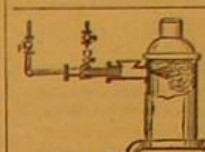
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